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CONTENTS

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The Madras Agricultural Journal.

Vol. XXVII—1939.

CONTENTS

Page.

JANUARY

Power Alcohol in other Countries
By C. N. Acharya 3

Grass flora of the Chittoor District with special reference to fodder grasses.
By K. Cherian Jacob 9

Fungus diseases—how they affect the wealth of the Madras Presidency.
By S. Sundararaman 19

Some Experiences of the Varying Response of Different Millets and Cotton Strains to Local Areas in Cuddapah and Kurnool Districts.
By R. Swami Rao and P. Subrahmanyam 25

Soil Erosion in India.
By Dr. R. MacLagan Gorrie 28

FEBRUARY

Ipomaea hispida, Roem. and Sch., A Useful Fodder Weed.
By G. N. Rangaswami Ayyangar & N. S. Rajagopal 47

The Buffaloe in the Madras Presisidency,
By M. L. Narayana Reddi 50

Tobacco stems as a useful source of nicotine for insecticidal purposes.
By M. C. Cherian and M. S. Kylasam 55

Bridging the gulf.
By G. Mahadevan 59

MARCH

Some Useful Orchard Equipments devised at the fruit Research Station, Kodur.
By K. C. Naik 74

Preliminary Studies in Coriander (Coriandrum Sativum L.)
By S. Mayandi Pillai 79

Page.

The use of the Digging Fork for the eradication of Hariali (Cynodan dactylon).
By M. Kalimuthu 85

Tea Cultivation in South India.
By E. A. Stone 88

Cardamoms.
By W. Molegode 91

APRIL

Border Effect on the Crop in Irrigated Sorghum.
By G. N. Rangaswami Ayyangar 112

Tea Cultivation in South India.
By E. A. Stone 119

A Preliminary Investigation on the Efficiency of some Fodders for Milk Production.
By M. Balakrishnan Nayar 122

The Hairy Caterpillar Pests in S. India.
By Dr. T. V. Ramakrishna Ayyar 127

The Collective Farm System in Russia.
By Dr. Harold H. Mann 135

MAY

Tea Cultivation in South India.
By E. A. Stone 157

Nitrogen Content of Sugarcane Juices and Colour of Cream Jaggery.
By G. Ganapathy Ayyar and K. Bhushanam 161

A Scheme for Opening Agricultural Graduate Colonies by Government.
By P. Parthasarathy 166

Seasonal Variations in the Flight Activities of Bees.
By R. Ratnam 170

The Storage of Tropical Fruits 176

JUNE

A Note on the Cultivation of Bananas in the Madras Presidency.
By K. Cherian Jacob 199

Notes on Perina Nuda Fabr., (Lymnt. Lepid.) and its Natural Enemies.
By M. C. Cherian and P. Israel 203

Large Scale trials on the Filtration of Cane Juice with Syphon Filter.
By G. Ganapathi Ayyar 208

The Occurrence and Inheritance of Hairiness of Leaf Tip in Sorghum.
By G. N. Rangaswami Ayyar and T. V. Venkataramana Reddi 210

Minor Elements in Fertilizer Practice.
By Prof. F. Menchikowsky 214

JULY

The Twenty-Eighth College Day and Agricultural Conference, 1939 229

Soil and Water Losses by Run-off
By A. Subba Rao, S. V. Kuppuswami & A. Abdul Samad 244

Rice Crop in Tanjore Delta.
By M. Anandan 247

AUGUST

Sugar Industry in Madras.
By R. V. Sundara Reddy 263

The Main Cause of Crop Failure in the Black Soil Tract of the Bellary District.
By C. Vijayaraghavan and V. Panduranga Rao 271

The Cultivation of Cambodia Cotton in the Central Districts.
By A. Kannayya 274

A new method in Mango propagation.
By Tyozaburd Tanaka 279

Cotton Cultivation in Italy (German Translation) 284

SEPTEMBER

Agricultural Extension work in America.
By J. J. De Valois 302

Research in Irrigation.
By S. Krishnamurthy 305

Cashewnuts.
By C. T. Ittyachan 313

The Scope of Pillipesara (Phaseolus trilobus) in the Solution of the Fodder Problem.
By G. Venkataratnam 324

The Principles of Manufacturing Fruit Juices. 326

OCTOBER

The Present Position of Pollu Disease of Pepper in Malabar.
By K. M. Thomas and K. Krishna Menon 348

Plantain in Madras Province and its Market.
By Louis J. Royal 356

Self-Help in Economic Farming
By K. Unnikrishna Menon 365

A Note on Vettiver Cultivation
By M. Gopala Chetty 369

The Influence of Manure on Potato 370

NOVEMBER

Coffee in South India.
By K. Sanjiva Shetty 388

Some Animals of Agricultural Importance in South India.
By Dr. T. V. Ramakrishna Ayyar 400

An Experiment on the Introduction of Agricultural Improvements in Villages on a mass scale
By M. A. Balakrishna Ayyar 404

The Scientist and the Farmer.
By Prof. E. R. Hudson 408

DECEMBER

A Preliminary Study in the Biometric Variation in the Indian Honey Bee.
By R. Ratnam 432

Sugarcane Cultivation in South Canara District.
By K. Tejappa Shetty 439

A Note on Arrowroot.
By P. Somayajulu 442

Science and the Indian peasant,
By E. J. Russel 433

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EDITORIAL

New Year Greetings. We wish all our readers a happy and prosperous New Year. We also take this opportunity to thank them and others who have helped us in various ways in the conduct of the Journal during the past year and hope that they will continue to give us their patronage this year also.

With 1939 the *Madras Agricultural Journal* has entered on its twenty-seventh year. It has usefully subserved the fostering of scientific agriculture. As an independent unsubsidized journal its continuance depends on the continued support and patronage of all those interested in agriculture both inside and outside the province; we appeal to every one of them tc extend this support in a greater measure.

We are also anxious to make further improvements in the Journal by publishing larger number of papers and also by introducing other attractive features. This will be possible only with the receipt of suitable contributions and an increase in the membership of the Union and the number of subscribers. We would therefore appeal to all those members of the Department who have not yet become members of the Union to do so at the earliest opportunity and bring in as many subscribers as possible to the fold and thus help in the efficient running of the Journal.

The Indian Science Congress. The Twenty-eighth annual meeting of the Indian Science Congress was held at Lahore from the 2nd to 8th January 1939 under the Presidency of Prof. J. C. Ghosh, D. Sc., F. N. I., Professor of Chemistry, Dacca. Dr. T. V. Ramakrishna Ayyar, B. A., Ph. D., retired Entomologist to the Government of Madras and a member of our Union presided over the Agricultural Section. In his masterly address on 'Insects and their role in Indian Agriculture' he dealt in detail with the extent of damage and loss to crops due to insect pests and the various methods of pest control. The concluding portion of his address contained very valuable suggestions regarding the future of economic Entomology in India.

Of the 664 papers read at the eleven sections, the agricultural section claimed as many as 56 dealing with subjects such as agronomy; soils; fertilisers and manures; crop pests and diseases; statistical methods and agricultural meteorology. It is gratifying to note that Coimbatore was responsible for 12 papers. At the joint meetings of sections several subjects of agricultural interest were discussed the more important of which were (1) erosion and drainage problems in India (2) disease and pest resistance in crops (3) composts and (4) experimental field trials.

Disease and Pest resistance in Cultivated crops. Pests and diseases are the bane and the curse of the crop-grower and he will be naturally pleased to know how best to avoid them or overcome them. Time-honoured methods like dusts and sprays, though indispensable, seek to destroy the pests and give relief for the moment but do not attempt to prevent a recurrance. It augurs well therefore that today the pest and disease control problems are receiving a new line of approach which has for its object the minimum incidence of these diseases.

The present day tendency is to regard them more as the manifest symptoms of the unhealthy condition of the plant than as the true cause inducing such expression in the plant; when once the unhealthy condition is corrected or removed, the symptoms vanish by themselves. In a work of this kind factors leading to disease and pest resistance are being utilized in large measure with great success.

Resistance is of two kinds; genetic and acquired. The plant breeders have not been slow to use the genetic resistance in evolving resistant strains. Coimbatore is famous for its mosaic-resistant canes; Pusa for rust resistant wheats and Africa for its jassid-resistant cotton. But very unfortunately for us the genetic resistance often breaks down if the material is transferred to new geographical areas. And one has to be breeding types to suit particular localities. We know cases of break down are the jassid resistant cotton (11/4) in Coimbatore; mosaic resistant cane (Co. 205) in North India etc. It is hoped that the attempts of our Cotton Specialist to evolve Pempheres resistant strains of cotton will be successful.

Acquired or induced resistance is brought about by proper soil treatment. It is well known that addition of certain elements like boron, silica, potash and iron have helped to correct the deficiency diseases. Peach aphis at Quetta could be got over by soil aeration, leaf curl and red leaf diseases of American cotton are supposed to be the result of soil deterioration during rainy weather and addition of argarine matter to improve the soil is found to be the necessary corrective. Coconut shoot rot infection could be got over by soil dressing with potash sulphate and deep planting. The well known betel vine diseases are put down to the super-saturated condition of the soil which brought about a defective water balance for which good drainage is the corrective.

Howard has suggested that a fungus, *Mycorrhiza* growing at the root tips of plants is directly connected with the transport of the important nutrient material from the humus into the plant and the presence or absence of it would seem to determine the nature of resistance; this is a claim which has been disputed and no doubt experiments have to be made to test the truth of this statement.

It is hoped that with the increasing knowledge and with the helpful cooperation of the breeder, pathologist, and entomologist ways and means of augmenting disease and pest resistance in crops may be found.

Power Alcohol in Other Countries.

BY C. N. ACHARYA, M. Sc., Ph. D., A. I. C.

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Now that the question of power alcohol is attracting much attention in this country and several provincial governments have seriously taken on hand schemes for its manufacture and use as motor-fuel, it would be interesting to examine how much attention this problem has received in other countries and how far attempts in this direction have been successful there.

The phenomenal development of the petroleum industry in the closing decades of the nineteenth century was mainly due to the rapid increase in the use of internal combustion engines for transport on land, in sea and in air, also for driving machinery and generally wherever a small scale source of power is necessary. Though power obtained through such engines is costlier than that obtained from coal or hydro-electric energy, the internal combustion engine possesses such marked advantages, wherever an intermittent source of power, easily transportable from place to place, is necessary, that its use has been rapidly increasing during the last few decades. Its importance in armaments is doubly great, on account of its use in all machines of modern warfare, e. g. tanks, aeroplanes and even battleships. The importance of petroleum, both in peace and in war, is therefore evident.

Unfortunately, supplies of petroleum are confined to a few countries principally U. S A., Mexico, Russia, Rumania, Persia, Iraq and Burma. With the growth of militant nationalism in most countries, in recent years, and a policy of national self-sufficiency in important raw-products, attempts have been made from the beginning of this century to find local substitutes in each country for petroleum.

Countries which have been blessed with a plentiful supply of coal, e. g. England, and Germany, have spent huge sums of money in researches on the conversion of coal into petroleum hydrocarbons. Their efforts have been crowned with success, as shown by the development of low temperature hydrogenation process for the conversion of coal into petroleum products, though it is admitted that the oil obtained thereby is costlier than petroleum obtained at present.

Other countries, such as France, Italy, Austria, Poland, Sweden etc., which possess neither abundant coal nor petroleum supplies, but are endowed with rich agricultural potentialities, have made strenuous attempts to find out other satisfactory substitutes for petroleum. The most promising substitute they have found so far is ethyl alcohol.

Serious attempts to use ethyl alcohol in internal combustion engines were started as long ago as 1894[1], but the earlier attempts in this direction met only with partial success on account of the fact that before the Great War, 95% alcohol was the most concentrated product that could be obtained on a large scale at economic prices. The presence of the 5% of water in

the fuel possessed various defects such as difficulties in blending with gasoline, loss of calorific power, engine trouble etc., and thus set a limit to the usefulness of the fuel.

But after the War, (since 1922) large scale methods for the preparation of absolute alcohol (100%) were developed and improved to such an extent that, today, absolute alcohol on the bulk scale could be produced at about the same price (4 as. to 6 annas per gallon) as 95% alcohol. These processes (chiefly, Melle, Drawinol and Hiag) have revolutionized the power alcohol industry and have helped it to grow by leaps and bounds during the last ten years (Table II).

The use of anhydrous alcohol for fuel purposes has served to overcome most of the disadvantages which 95% alcohol formerly possessed, and has thus made alcohol a serious competitor to petrol.

The relative advantages and disadvantages of alcohol as against petrol as motor fuel have been discussed at various conferences of petroleum technologists and others, both in Europe and in America [2, 3, 4, 5]. On a theoretical basis, the chief disadvantage of alcohol has been stated to lie in its lower calorific power as compared with petrol, the relative values being 11,690 B. T. U. per lb. of alcohol and 16,800 B. T. U. per lb. of petrol[5]. This, on theoretical considerations, would necessitate the consumption of a proportionately greater amount of alcohol than petrol in order to obtain the same output of energy. But this disadvantage is in actual practice, to a great extent counterbalanced by certain marked advantages of alcohol over petrol, e. g. (1) the smaller amount of air necessary for the complete combustion of alcohol, the volume of air required being 9 lbs. per lb. of alcohol, as against 15 lbs. required per lb. of petrol[5]; thus, under ordinary conditions, a more complete combustion of alcohol takes place in the engine than of petrol, with the liberation of a proportionately greater amount of energy in the former case; (2) the superior "anti-knock" value of alcohol; thus admixture of petrol with 20 % of alcohol is equivalent to adding 44 % of benzol[5], (3) the higher Octane number of alcohol (about 90) compared with that of gasoline (about 60 to 65); and (4) as a consequence of the above two properties, the alcohol engine can work at a higher compression value than a petrol engine, without knocking: the H. U. C. R. for alcohol is 7 to 8 while that for petrol[5] is 4·5 to 5. Since the increasing tendency at present is to manufacture engines of compression ratio 5·5 and higher, it is found in practice that the efficiency of an alcohol engine is much higher (25:15) than that of a petrol engine [4, 6]. This increased efficiency counterbalances the lower calorific value of alcohol; and thus, within certain broad limits, the actual output of work per gallon of fuel is found to be greater in the case of alcohol blends than on straight petrol [2, 3, 4]. Most modern racing engines, in fact, possess high compression ratios and are adapted to run on fuels which possess alcohol as the base.

The use of straight (unblended) alcohol, however, as fuel necessitates radical alterations of the present type of engines, whose compression ratios, carburettor adjustments and fuel-air ratios have been adapted to the use of

petrol. Such alterations, however, are unnecessary if a mixture of petrol with alcohol in suitable proportions be used, instead of pure alcohol. The preparation of such blends was subject to serious limitations, when 95% alcohol was in use, but these difficulties no longer exist now, since anhydrous alcohol is miscible with petrol in all proportions.

Various trials run in America and in Europe [2, 3, 4, 5] with different types of motor engines have shown that when the proportion of alcohol in the petrol-alcohol blend is below 30%, the mixed fuel can be used in the present type of engines in use, without any alterations (except possibly for a slight adjustment of the carburettor opening), and the blend gives the same and in several cases a higher mileage per gallon than straight petrol. Starting is easier and the anti-knock value of the blend is superior. The anti-calamine value of the blend is markedly improved. Reports of corrosion of the engine parts were found to be due to the denaturants used for alcohol, rather than to the alcohol itself.

Advantage was taken of these marked superiorities of the mixed fuel, by most of the European countries, in order (1) to serve their national and political interests by developing a source of power within their own boundaries which they could depend upon in times of war; and (2) to encourage their home grown agricultural products, by creating an additional market for them.

As, however, popular prejudice was intitially against the innovation, most of the European countries had to resort to legislation to enforce a compulsory mixing of petrol with alcohol in all motor fuels sold to the public. There are very few countries at present in Europe or America, outside the petroleum producing group, which have not passed such legislation; and it is not surprising that a similar move should be made in India also.

Sources of Power Alcohol. The economics of alcohol production from different sources have been dealt with in detail by Monior Williams (pp. 86 *et seq.*; vide also Nash & Howes, pp. 483 *et seq.*). Now that the price of petrol is fairly low, it is necessary that the cheapest source of alcohol should be resorted to, if alcohol is to compete with petrol, or if admixture of petrol with alcohol is not to increase the cost of motor fuel.

It is interesting to note the variety of sources from which Germany is deriving its alcohol production which amounted in 1936—37 to about 4 million hectoliters[7] (vide Table I).

TABLE I. Alcohol production in Germany.

Source	1935–36	1936–37
1. Potatoes	1,973,295 tons	2,022,558 tons.
2. Sulphite liquors	67,603,097 hl.	74,650,619 hl.
3. Molasses	199,797 tons	205,515 tons.
4. Stone fruit and Residues	425 612 hl.	205.443 hl.
5. Grape vine juice	189,240 hl.	246,295 hl.
6. General cereals	141,294 tons	63,172 tons.
7. Non-cereal products	419 866 hl.	335,537 hl.
8. Dry wood substance	11,371 tons	30,609 tons.
9. Brewery residues	1,183 hl.	1.643 hl.
10. Calcium carbide	419 tons	1,006 tons.
11. Wood sugar molasses	230 tons	1,301 tons.

The chief sources at present in Germany are potatoes (2·3 million hl. of alcohol) and sulphite waste liquors.

In addition to the above sources, mention should be made of cane molasses, which is the most promising source for India, juices of palms such as palmyra, coconut and Nipah, and several flowers and tubers rich in sugars or starch. Very favourable reports have been made of the potentialities of Nipah for this purpose[8]. Similar studies do not appear to have been made yet in India regarding the economics of alcohol production from the coconut and palmyra juices. Mhowra flowers (*Bassia latifolia, B. longifolia* and *B. butyracea*) are available in large quantities in the Central Provinces and in Hyderabad and would doubtless prove an attractive source for the preparation of alcohol[1] in that area. Charlton[9] recently examined the suitableness of broken rice (available in large quantities in Burma) as the raw material for the preparation of power alcohol and arrived at the conclusion that it was not a paying proposition.

The following paragraphs give an idea of the growth of the power alcohol industry in some of the principal countries of the world, and the scope of government legislation on the matter in those countries.

Germany. Germany was one of the earliest countries to tackle the problem of power alcohol, especially as she had a huge production of alcohol from potatoes and beet molasses, for which there was no ready market. It was at Leipzig that Hartmann[1] first started in 1894 large scale investigations on the suitability of alcohol as motor fuel, under the auspices of the Deutsche Landwirtchaftliche Gesellschaft. These experiments were further extended by the "Centrale für Spiritus Verwertung" - a co-operative organization of alcohol distillers.

Under the Spirit Monopoly Act of 1918, the State took over control of the production and distribution of alcohol throughout Germany. At the present time[2], there are two kinds of motor fuel used in Germany, one containing 11% of absolute alcohol and 89% of petrol, and the other containing about 3% of absolute alcohol, 3·5 to 5% of methanol, 35% of benzol and the rest petrol. Since June 1936, binary motor fuels contain in addition 20% of methanol.

France. Since the close of the War, France has been showing a keen interest in the utilization of alcohol for power purposes. It was in France that in 1922 the first satisfactory process for the manufacture of absolute alcohol (Melle process) was worked out on a large scale and put into commercial practice.

In October 1931, a decree was passed[5] compelling importers of gasoline and other products used as motor fuel, to add to such products 25–35% by volume of anhydrous alcohol (Heavy Carburant Nationale). This decree affected in the first instance only commercial vehicles plying for hire, such as lorries and trucks, but was soon followed by another decree passed on 14th November 1931, which compelled the addition of 10% by volume of

alcohol to all gasoline imported into the country irrespective of the kind of vehicle for which it was used.

England. England, not being an agricultural country, has devoted more attention to processes for the conversion of coal into petroleum products, rather than to the production and use of power alcohol. Still, the availability on the world market of cheap molasses from sugar producing countries, has tempted her to manufacture power alcohol on a large scale. Such production increased rapidly in recent years and was consumed mainly in the preparation of suitable blends with petrol. But this year Government have introduced a duty of 9 d. per gallon on alcohol so produced for power purposes (10).

The rapid growth of the power alcohol industry in Germany, France and England, in recent years, is shown in the following table:

TABLE II. Power alcohol production in some countries.

Year.	France[2].	Germany[2].	England[5].
	(gallons)	(gallons)	(gallons)
1929—30	7.716,000	5,175,000	15,000
1931—32	18.827,000	25,657,000	56,610
1933—34	54,388,000	45,823,000	391,014
1935—36	88,000,000	48,509,000	1,475 275
1936—37			2,925,000

Italy. A Government decree of December 9th, 1931 provided for the mixing of 99·6% ethyl alcohol with imported gasoline in the ratio of 1 : 4. Producers of domestic gasoline were not exempt from this law. A further decree of 7th November 1935 reserves the total production of alcohol from beet root and a proportion of alcohol from other raw materials for use as motor fuel. A mixture of alcohol and ether has recently been adopted for aeroplane engines.

Hungary. A decree of 1929 made it compulsory for all gasoline of sp. gr. 0·735 or over to be mixed with 20% by volume of alcohol. The alcohol—gasoline mixture is marketed under the name of "Motalko". The power alcohol industry is controlled in Hungary by a monopoly known as the National Alcohol Trading Company.

Sweden. Waste sulphite liquor, from paper mills, is the important source of alcohol in this country. In 1931, 79,260 barrels of alcohol were produced from the above source of which 48,000 barrels were used as motor fuel, mixed with gasoline under the trade name of "Lattbentyl" (75% of gasoline with 25% of alcohol). By the law of October 1, 1934, importers and producers of gasoline were compelled to purchase alcohol at the rate of 3·6% of the total volume of gasoline imported or produced.

Yugoslavia. Under regulations issued by the Minister of Finance on 29th September 1932, all motor fuels having a density less than 0·795 at 15°C, were compelled to be mixed with 25% by weight of alcohol. By a

further decree, which became effective on 1st December 1932, motorists in Yugoslavia are forbidden to drive motor vehicles on any fuel other than this alcohol blend[5].

Other European Countries. Legislation for the compulsory blending of gasoline with alcohol have also been passed in Austria, Czechoslovakia, Latvia, Spain, Bulgaria, Finland, Lithuania and Poland. Among the countries which have not yet made such compulsory legislation may be mentioned England, Holland, Norway, Portugal, Greece and Rumania.

The growing importance of alcohol in motor fuels is shown by the following figures taken for the year 1935 :—

TABLE III. Use of Alcohol fuels in European countries.[5]

Country.	Metric tons consumed.	Price of alcohol cents per gallon.	Number of motor vehicles.	Cost per motor vehicle U. S.	Total cost of alcohol fuel to country.
1. Austria	4,400	57	45,000	17,50	793,000
2. Czechoslovakia	42,477	76	90,000	61.66	5,549,800
3. France	293,600	27	2,182,000	35,50	77,529,000
4. Germany	180,000	76	1,104,000	55,87	61,688,000
5. Hungary	8,731	79	15,200	136,30	2,072,000
6. Italy	5,000	88	392,000	4 00	1,577,000
7. Jugoslavia	6,592	40	10,400	21,83	227,000
8. Latvia	5,457	59	3,950	356,00	1,408,000
9. Poland	5,941	19	25,200	33.73	851.000
10. Spain	12,000	52	179,500	1·13	204,000
11. Sweden	12,250	31	154,800	6,37	986,000
Total	576,448		4,202,050		152,884,000

South Africa. Among the non-European countries, South Africa began to take a keen interest in the power alcohol question some 20 years ago. The Natal Cane By-Products Ltd, first marketed in 1917 a motor fuel known as "Natalite", which consisted of 60% of ethyl alcohol and 40% of ethyl ether. When prices of petrol rapidly fell in the post-war period, the above Company marketed a mixture of equal parts of Natalite and gasoline under the name of "Union Motor Spirit". At that time, however, the alcohol used was 94—95% only and this gave rise to some engine trouble especially with die-cast zinc carburettors and the metal tops of auto-vac tanks. But after the installation of modern processes (Melle) for the preparation of absolute alcohol, the above troubles have disappeared. The Government of the Union of South Africa, with a view to encourage the use of alcohol-blended motor spirit allowed a rebate of the whole duty payable on gasoline (6 d. per gallon) in proportion to the alcohol contained in the fuel. This rebate has since been reduced to 3d. per gallon[5].

Among the American countries, Brazil, Chile, Cuba, Philippines, Panama, Salvador, etc. have also passed regulations in favour of petrol-alcohol blends.

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Grass Flora of the Chittoor District with special reference to Fodder Grasses.

BY K. CHERIAN JACOB, L. Ag., F. L S.

The growth of grasses depends on the amount of rain received. Four to five inches of rain received in four or five showers spread over ten to fifteen days is the minimum rainfall required for the grasses to grow and set seed. There was a rainfall of 12 inches in September 1938 in the Chittoor District and as many as 56 species of grasses were in flower in October 1938. Of these about 40 are of good fodder value.

Even though the species of grasses found in the various districts of the Presidency do not vary much, the predominance of a few good fodder grasses in given areas makes those places suitable for cattle-rearing. For example, the predominance of *Kolukkattai* grass (*Cenchrus ciliaris*, Linn.) in the Kangayam tract of Coimbatore District contributes to a large extent to the success of the famous Kangayam breed of cattle of that district and similarly *Cheng. li Gaddi* (*Iseilema laxum*, Hack.) to the Ongole breed of cattle of Nellore District. Both these well-known fodder grasses are absent in the Chittoor District and one step towards the solution of the fodder problem of this district may lie in the introduction of these two important grasses into this district. It is thus essential that a grass survey of the various districts of the Presidency should be made at the outset. It is only after taking stock of the fodder grasses of given areas that any suggestion regarding the solution of the grazing problem can be made.

Grasses may be either annuals or perennials. In tropical countries especially in South India many species of annuals appear with the commencement of the monsoon and die out in summer after setting seed, while the perennials survive the summer, even though the shoots may dry up and

break off. The annuals require a good deal of moisture and fertility in the soil and in the absence of the optimum quantity of these, they slowly give place to the perennials.

In the Hosur Cattle Breeding Station, Salem District, hay is stacked in paddocks of pure growth of *Heteropogon contortus,* Beauv. (Spear grass) but when the hay stack is removed, annuals such as *Brachiaria ramosa* Stapf. (*Panicum ramosum,* Linn.), *Urochloa panicoides,* Beauv. (*Panicum javanicum,* Hook), *Urochloa reptans* Stapf. (*Panicum prostratum,* Lamk), *Echinochloa colona,* Link. (*Panicum colonum,* Linn.), *Setaria intermedia,* R. &. S., *Dactyloctenium aegyptium,* Beauv. (*Eleusine aegyptiaca,* Desf.) *Eragrostis cilianensis,* Link. (*Eragrostis major,* Host.), etc., grow in places where the hay was stacked, surrounded by the common grass of the paddock, the Spear grass. The growth of these annuals is due to the accumulated organic manure derived from the hay stack. These annuals give place to perennials like *Amphilophis pertusa,* Stapf., *Digitaria marginata,* Link., var. *fimbriata,* Stapf, etc., in the course of the next one or two years; and as the fertility decreases the hardy Spear grass, which can subsist on the minimum moisture and plant food once again takes possession of the field ousting the less hardy perennials. In the forests where spear grass is predominating, *Amphilophis pertusa,* Stapf. (*Andropogon pertusus,* Willd.) is seen on old white-ant mounts in the midst of the Spear grass. This indicates that the hardy species of grasses establish themselves, replacing the less hardy ones as the fertility of the soil decreases.

A good fodder grass should be perennial in habit and should stand cuttings, with a good growth of vegetative parts without any of the defensive weapons, such as, rough hairs, strong odour, penetrating awns or barbs, lignified tissue and the like.

The importance of the trailing leguminous plants like the species of *Alysicarpus,* etc., in pastures cannot be underestimated. These take the place of clover in the pastures of European countries. Leguminous plants like these not only afford good fodder for cattle but also fix the atmospheric nitrogen into the soil thereby enriching it. It is therefore necessary to encourage the growth of leguminous plants in pastures.

The grasses of the district may be roughly classified into 3 groups, viz., the pasture grasses, grass weeds in standing crops and the forest or hill grasses. The cattle belonging to the ryots of this district depend for their fodder on all the above 3 groups of grasses.

The important grasses of the pastures are :—

Amphilophis pertusa. Stapf. *Digitaria marginata*. Link. var., *fimbriata*, Stapf. *Brachiaria distachya*, Stapf. *Brachiaria eruciformis*, Griseb. *Brachiaria ramosa*, Stapf. *Paspalidium flavidum*, A. Camus. *Urochloa reptans*. Stapf *Urochloa panicoides*. Beauv. *Echinochloa colona*, Link. *Setaria pallidifusca*, Stapf. et. Hubbard.

Aristida depressa, Retz. *Tragusibiflorus*, Schult. *Sporobolus diander*, Beauv. *Sporobolus coromandelianus*, Kunth. *Eragrostis plumosa*, Link. *Oropetium Thomaeum*, Trin. *Cynodon Dactylon*, Pers. *Cynodon Barberi*, Rang. & Tad. *Chloris barbata*, Sw. *Dactyloctenium aegyptium*, Beauv.

All the above species of grasses except *Aristida depressa,* Retz, *Oropetium Thomaeum,* Trin., *Sporobolus diander,* Beauv, and *Sporobolus coromandelianus,* Kunth. are good fodder grasses.

The grasses growing in standing crops as weeds generally attain their maximum growth and luxuriance. The following are the important grasses in the standing crops :—

Amphilophis pertusa, Stapf. *Digitaria marginata*, Link var., *fimbriata*, Stapf. *Alloteropsis cimicina*, Stapf. *Brachiaria distachya*, Stapf. *Brachiaria ramosa*, Stapf. *Paspalidium flavidum*. A. Camus. *Urochloa reptans*, Stapf. *Urochloa panicoides* Beauv. *Echinochlaa colona*, Link. *Panicum repens*, Linn. *Setaria pallidifusca*, Stapf et Hubbard. *Setaria intermedia*, R. & S. *Aristida depressa*, Retz. *Tragus muricata*, Steud. *Tragus biflorus*, Schult. *Sporobolus diander*, Beauv. *Eragrostis ciliianensis*, Link. *Eragrostis pilosa*, Beauv. *Cynodon Dactylon*, Pers. *Cynodon Barberi*, Rang. & Tad. *Chloris barbata*, Sw. *Dactyloctenium aegyptium* Beauv.

All the above grasses except *Aristida depressa,* Retz. and *Sporobolus diander,* Beauv. are good fodder grasses. The cut grasses sold in headloads as fodder in this district consist mainly of the above species.

The important forest or hill grasses are :—

Sehima nervosum, Stapf. *Lophopogon tridentatus*, Hack. *Amphilophis pertusa*, Stapf. *Chrysopogon montanus*, Trin. *Heteropogon contortus*, Beauv. *Themeda triandra*, Forsk. *Iseilema prostratum*, Anderss. *Apluda aristata*, Linn. *Eremopogon foveolatus*, Stapf. *Cymbopogon flexuosus* Wats. *Cymbopogon coloratus*, Stapf. *Cymbopogon Martini*, Wats. *Cymbopogon Gidarba*, Haines. *Hackelochloa granularis*, O. Ktz. *Mnesithea laevis*, Kunth. *Digitaria marginata*, Link., *var.*, *fimbriata*, Stapf. *Digitaria longiflora*, Pers. *Alloteropsis cimicina*, Stapf. *Brachiaria distachya*, Stapf. *Brachiaria eruciformis*, Griseb. *Brachiaria ramosa*, Stapf. *Panicum trypheron*, Schult. *Cyrtococcum trigonum*, A Camus. *Setaria pallidifusca*, Stapf. et Hubbard. *Setaria intermedia*, R. & S. *Setania verticillata*, Beauv. *Arundinella setosa*, Trin. *Aristida depressa*, Retz. *Aristida setacea*, Retz. *Aristida Hystrix*, Linn. *Tragus biflorus*, Schult. *Perotis indica*, O. Ktz. *Sporobolus diander*, Beauv. *Eragrostis spicata*, Jedwabn. *Eragrostis riparia*, Nees. *Eragrostis plumosa*, Link. *Eragrostis tenuifolia*, Hochst. *Eragrostis pilos*, Beauv, *Eragrostis bifaria*, Wt. *Eragrostis brachyphylla*, Stapf. *Oropetium Thomaeum*, Trin. *Cynodon Dactylon*, Pers. *Cynodon Barberi*, Rang. & Tad. *Chloris barbata*, Sw. *Dactyloctenium aegyptium*, Beauv.

Sehima nervosum, Stapf. (Tel : *Nendra Gaddi*), the most important of the hill grasses is very common in all the forest regions of this District. *Cymbopogon Gidarba,* Haines. (Tel : *Adavi Kanchi*), another important fodder grass is also found in many parts of these forests. A good majority of the above mentioned grasses except *Aristida depressa,* Retz., *Aristida setacea* Retz , *Aristida Hystrix* Linn. *Arundinella setosa,* Trin , *Oropetium Thomaeum,* Trin., *Cymbopogon coloratus,* Stapf. *Cymbopogon Martini* Wats., *Cymbopogon flexuosus,* Wats., *Mnesithea laevis,* Kunth. *Themeda triandra,* Forsk, and *Setaria verticillata* Beauv. are good fodder grasses. A good part of the forest revenue of this District is derived from grazing permits issued to cattle owners. The forest grazing can be improved

by rotational system of grazing and by growing *Sehima nervosum,* Stapf. (Tel: *Nendra Gaddi*) wherever it is absent and by the introduction of *Iseilema laxum,* Hack. (Tel: *Chengali Gaddi*); *Cenchrus ciliaris,* Linn. (Tam: *Kolukkattai Pullu*) and *Chionachne Koenigii,* Thw. (Tel: *Gela Gaddi*) from other districts.

Albizzia amara, Boiv. (Tel: *Nalla Renga*; Tam: *Wunja*), a very common leguminous tree found especially in the forests of this district affords a valuable fodder for cattle. This forage plant supplements the fodder grasses of this district. It is therefore suggested that forage plants like the above may be grown in village porambokes, unreserved forests and also in non-remunerative reserved forests to supplement the fodder grasses.

A full list of the grasses of the Chittoor District with short notes and local names wherever available is given below. Old botanical names are given within brackets along with the new names wherever there have been changes, since most of the readers of this Journal may be familiar with the old names.

1. *Sehima nervosum,* Stapf. (*Ischaemum laxum,* R. Br.)

Tel: Nendra Gaddi; Neradi Kasuvu. Kan: Nalai hullu.

It is the best of the hill fodder grasses It grows in very large clumps putting forth probably the largest number of tillers in any of the Indian grasses. It grows to 2'—3' in height and stands cuttings well. It is rather difficult to get this grass established in a new locality. Cattle improve rapidly when they graze this grass. It is found in all the reserved forests of this District.

2. *Lophopogon tridentatus,* Hack.

It grows to 1'—1½' in height. It thrives in very dry localities in the scrub jungles and is not considered a good fodder grass. Cattle, however, nibble it before flowering.

3. *Amphilophis pertusa,* Stapf. (*Andropogon pertusus,* Willd.) Tel: Kanthalam; Genjulu Geruge. Kan: Karai Kanda Hullu. Tam: Chinna Karai Pullu.

It is very common throughout the Presidency and is one of the best pasture grasses. It covers the ground by its slender creeping stems. Though the output of forage is rather small, it is considered one of the good fodder grasses. When fertility of the soil diminishes, it is ousted by *Heteropogon contortus,* Beauv. (Spear Grass).

4. *Amphilophis pseudoischaemum,* C. E. C. Fischer n. comb. (*Andropogon pseudoischaemum,* Nees)

Tel: Neetiyeedava.

It is a very rare grass growing to 5' in height. It is a good fodder grass.

5. *Chrysopogon montanus,* Trin. (*Andropogon monticola,* Schult.)

Tel: Gurra Batto Kelu; Nakka Baroganta.

It is a common grass of the scrub jungles growing to 1½′ in height. It is gregarious in habit and is easily made out even from a distance on account of its gold coloured inflorescence. Cattle graze this grass but do not relish it much after flowering. The output of forage is small.

6. *Heteropogon contortus,* Beauv. (*Andropogon contortus,* Linn.)

Eng: The Spear Grass. Tam: Oosi Pullu. Tel: Pandi Oopa: Pandu Mullu Gaddi Kan: Sunkari Hullu.

It is the commonest grass in all the forest areas of this Presidency. It is a hardy grass growing to 2′ in height and is much relished by cattle before flowering. Cattle graze it also after the awns drop off. It ousts all other grasses in poor and rocky soils. It makes excellent hay and silage if cut before or at the time of flowering.

7. *Themeda triandra,* Forsk. (*Anthistiria imberbis,* Retz.)

Tel: Pedda Yerra Kalla Kasuvu. Tam: Erigai Thattu Pullu.

It grows to 4′ in height and is used for thatching. Cattle nibble this grass when young. It occurs in all the forest areas.

8. *Iseilema prostratum,* Anderss. (*Iseilema Wightii,* Anderss.)

Tel: Yerra Kala Kasuvu.

It is a rare grass growing to 1½′—2′ in height and is an excellent fodder.

9. *Apluda aristata,* Linn. (*Apluda varia,* Hack. subsp. *aristata,* Hack.)

Tel: Burra Kanchi. Kan: Akku Hullu. Tam: Manda Pullu.

It is a common hill grass growing to 4′—5′ in height and rooting from the basal nodes. It is a good fodder grass readily eaten by cattle before flowering. There is a tendency for the stems to break off after the spikes mature. There is a slender and a robust form in this species.

10. *Eremopogon foveolatus,* Stapf. (*Andropogon foveolatus,* Del.)

It is a common grass met with in the hills and plains. It grows to 1½′—2′ in height. It is one of the best fodder grasses. The yield of fodder is not high because of the slender habit of the plant.

11. *Cymbopogon flexuosus,* Wats. (*Andropogon Nardus,* Linn. var. *flexuosus,* Hack.)

Eng: The Malabar Lemon Grass; the Ginger Grass. Kan: Anthi Balai Tam: Sukkunari Pullu.

This hill grass grows to 6′--8′ in height. The stem will be often as thick as the little finger. It is cultivated extensively especially in Travancore and Cochin for the extraction of the essential oil "Malabar Lemon-grass oil". This grass is also used for thatching purposes. It is unfit as a fodder grass because of its strong odour. There is a white and a purplish form in this species.

12. *Cymbopogon coloratus,* Stapf. (*Andropogon Nardus,* Linn., var. *coloratus,* Hook. *f.*)

Tel: Bodha.

It grows to 2′—3′ in height and is confined to the scrub jungles. It is used for thatching. It is not grazed by cattle because of the strong odour it possesses.

13. *Cymbopogon Martini*, Wats. (*Andropogon Schoenanthus*, Linn. var., *Martini*, Hook f.)

Tel: Kanchi; Kasi Gaddi. Kan: Kasi Hullu. Tam: Kavattan Pullu.

It grows to 4′—5′ high occurring mostly in hills and sometimes in waste places. It is sometimes cultivated for the essential oil it contains. The oil extracted is commercially known as "Geranium oil" or "Rusa oil". It is not touched by cattle because of its strong odour. This grass is also used for thatching.

14. *Cymbopogon Gidarba* Haines.

Tel: Adavi Kanchi:

This hill grass grows to 3′—4′ high. This is the only Madras species of *Cymbopogon* which possesses no odour. It is a very good fodder grass. A white and a purplish form occur. This grass should be introduced into localities where it is absent.

15. *Hackelachloa granularis*, O. Ktz. (*Manisuris granularis*, L.)

Tel: Uppu Ganta Kasuvu; Kuru Jedanai Gaddi. Kan: Kadu Sanna Harka Hullu.

It is a rare grass growing to 1½′ in height. It is moderately a good fodder.

16. *Mnesithea laevis*, Kunth. (*Rottboellia perforata*, Roxb.)

Tel: Koriki; Panuku. Kan: Sunku Dabbai Hullu.

It grows to 3′—4′ in height in the bed of hill streams. It is not grazed by cattle, except when the plants are very young.

17. *Digitaria marginata*, Link., var. *fimbriata*, Stapf.

Eng: Crab grass. Tel: Peddootla Gaddi. Kan: Henna Akkibu Hullu. Tam: Arisi Pullu.

It is a common grass found everywhere. It grows to 1½′—2′ in height with a spreading habit. It is one of the best fodder grasses. Being a slender grass, the quantity of forage produced is not much.

18. *Digitaria longiflora*, Pers. (*Pasapalum longiflorum*, Retz.)

Tel: Pora Kasuvu; Pakuru Gaddi. Kan: Tapari Hullu.

It is a slender grass growing to 1½′ in height. It occurs mainly in forest tracts. It is a good fodder grass.

19. *Alloteropsis cimicina*, Stapf. (*Axonopus cimicinus*, Beauv.)

Tel: Borrapala Gaddi. Kan: Neru Sajjai Hullu.

It is an annual growing to 2′ in height. Cattle readily graze this grass. It is not considered a good fodder grass on account of the low yield of forage and its annual habit. It is a common grass found both in arable lands and forest regions.

20. *Brachiaria distachya,* Stapf. (*Panicum distachyum,* Linn.

Tel: Koranna Gaddi. Kan: Hambu Haraka Hullu.

It is a common pasture grass spreading on the ground. It does not thrive in dry situations. Cattle graze it readily but the fodder produced is not much.

21. *Brachiaria eruciformis,* Griseb. (*Panicum Isachine.* Roth.)

Tel: Edira Kasuvu; Domakalu Gaddi.

It is a slender grass growing to $1\frac{1}{2}'$ height. It thrives in black cotton soils. Cattle graze it readily but the quantity of forage produced is not much.

22. *Brachiaria ramosa,* Stapf. (*Panicum ramosum,* Linn.)

Tel: Eduri Gaddi. Kan: Kadu Baragu Hullu.

It is an annual growing to 2' in height. It is chiefly met with as a weed in standing crops. Cattle graze this readily. It does not thrive in dry situations. It is cultivated by Muhammadans near Vizagapatam town for the grain which is used for making bread.

23. *Paspalidium flavidum,* A. Camus. (*Panicum flavidum,* Retz.)

It is a spreading annual. It thrives in moist situations and is one of the best pasture grasses of this district. Cattle relish it well.

24. *Urochloa panicoides,* Beauv. (*Panicum javanicum,* Hook.)

Tel: Salla Wudu. Kan: Kadu Billi Samai Hullu.

It is also a spreading annual thriving in moist situations. It is one of the pasture grasses of this district. Cattle relish this well.

25. *Urochloa reptans.* Stapf. (*Panicum prostratum,* Lamk.)

Tam: Shani Pullu.

It is an annual thriving in moist situations. It is one of the pasture grasses with a spreading habit. The quantity of forage produced is not much. The grain is said to be eaten by the poor in times of scarcity.

26. *Echinochloa,* Link. (*Panicum colonum,* Link.)

Tel: Otha Gaddi; Kaproda Gaddi. Tam: Karum Pul; Varsanum Pullu.

It grows to $1\frac{1}{2}'$ in height and is decumbent. It is an annual, thriving only in moist situations. It is relished by cattle. Grain is said to be eaten by the poor.

27. *Panicum trypheron,* Schult.

Tel: Adavi Satha Gaddi. Kan: Kadu Karai Samai Hullu. Tam: Samai-karunai.

It is an annual growing to 2' in height. It occurs largely in the forests and is relished well by cattle.

28. *Panicum repens,* Linn.

Tel: Lada Gaddi; Kari Gaddi. Kan: Sonti Hullu. Tam: Inji Pullu; Tinei Pullu.

It grows to $1\frac{1}{2}'$ in height thriving in wet situations. It is found chiefly on the bunds of paddy fields. It is much liked by cattle and is said to stimulate the yield of milk.

29. *Cyrtococcum trigonum,* A. Camus. (*Panicum trigonum,* Retz.)

Kan: Abbu Karkai.

It is a spreading grass occurring in the forests under shade. It is relished by cattle but the quantity of forage produced is very little.

30. *Setaria pallidifusca,* Stapf et Hubb. (*Setaria glauca,* Beauv.)

Tel: Nakka Kora; Kuradakori Gaddi.

It is an annual growing to 1½′ in height and thriving in moist situations. Cattle graze it readily. The grain is said to be eaten by poor class of people.

31. *Setaria intermedia,* R & S.

Tel: Arranki Gaddi. Kan: Dodda Anta Purlai Hullu.

It grows to 1½′ in height thriving in moist and shady places. It is relished by cattle but not considered a good fodder grass on account of its annual habit.

32. *Setaria verticillata,* Beauv.

Tel: Chik Lenta; Aranta. Kan: Sanna Anta Purlai Hullu.

It is an annual often rambling on bushes in hedges. It grows to 3′ in height. Cattle graze it before the spikes appear but it is not touched by them after the spikes appear on account of the reversed barbs on the bristles of the involucre.

33. *Arundinella setosa,* Nees.

Tel: Pathi Oopa Gaddi; Chappadi Kasuvu. Kan: Hakki Varji Hullu; Maraga Thattu Hullu.

It grows to 3′ in height and is confined mainly to the forest regions. It is not relished by cattle.

34. *Aristida depressa,* Retz. (*Aristida adscencionis,* Linn.)

Kan: Kari Sanna Hanchi Hullu. Tam: Kodai Balla Pullu.

It grows to 1½′ in height. It occurs in the plains and hills. It is not a fodder grass.

35. *Aristida setacea,* Retz.

Tel: Paraka Gaddi. Kan: Dodda Hanchi Hullu. Tam: Thudappam Pullu.

It grows to 2′ - 3′ in height and is found in all the dry forest regions. It is used for making brooms. It is not grazed by cattle.

36. *Trachys muricata,* Steud. (*Trachys mucronata,* Pers.)

This annual grows to 1½′ in height and is procumbent. It is a rare grass found as weed in standing crops. Cattle graze this readily.

37. *Tragus biflorus,* Schult. (*Tragus racemosus,* Hook f.)

Tam: Ottu Pullu.

It is a low spreading grass growing to 3″—8″ high. It is not readily eaten by cattle because of the spiny spikelets sticking to their mouth-parts. It thrives in dry and sandy localities.

38. *Perotis indica,* O. Ktz. (*Perotis latifolia,* Ait.)

Tel: Boosra Gaddi; Nakka Toka. Kan: Nari Meesai Hullu. Tam: Narival Pullu; Kudirai-val Pullu.

It is a very slender grass growing to 1′ - 1½′ high. The leaves are few and are close to the ground; hence not considered a good-fodder grass. It thrives in sea-shore sands and dry places.

39. *Sporobolus diander,* Beauv.

Kan : Navalu Dondi Hullu.

It grows to 1½′ in height and thrives in shady places. It is grazed by cattle, but the fodder produced is not much.

40. *Sporobolus Wallichii,* Munro ex Hook f.

Tel : Konda Paraka.

It grows to 2′ in height and thrives in shady situations. The leaves are confined to the basal portion. It is grazed by cattle.

41. *Sporobolus coromandelianus,* Kunth.

Kan : Nari Balada Hennu Hullu.

It grows to 1′ high and is a common grass of the pastures. It is a poor fodder.

42. *Eragrostis spicata,* Jedwabn.

Kan : Kadu Nawanai Hullu.

It grows to 1′ high and is a rare grass. Cattle graze this.

43. *Eragrostis riparia,* Nees. (*Eragrostis tenella,* Roem. et *Sch. var. riparia,* Stapf.

Kan : Kadu Kambu Hullu.

It is slender grass growing to 1½′ high. It is found in the hills and plains. It is a good fodder grass but the quantity of forage is not much.

44. *Eragrostis plumosa,* Link. (*Eragrostis tenella,* Roem. et *Sch. var. plumosa,* Stapf.

Tel : Chinna Garikai Gaddi Kan : Sanna Purlai Hullu.

It grows to 1′ high and is often seen in patches. It is a slender grass grazed by cattle

45. *Eragrostis cilianensis,* Link. (*Eragrostis major,* Host.)

Kan : Bettada Akabu Hullu.

It is an annual growing to 2′ in height, often found as weeds of culivation. It is a rare grass readily eaten by cattle.

46. *Eragrostis tenuifolia,* Hochst.

Kan : Thodda Karakai Hullu.

It grows to 1½′ in height and is often found in the forest regions under shade. It is grazed by cattle but the fodder produced is not much.

47. *Eragrostis pilosa,* Beauv.

Kan : Kadu Sanna Samai Hullu.

It grows to 2′ in height, often seen as a weed in standing crops. In some localities it is said to be much liked by cattle; elsewhere reported to be rejected by them.

48. *Eragrostis bifaria,* Wt.

Tel : Nakka Piththu Kasuvu ; Gubbikal Gaddi. Kan : Kodi Mara Hullu ; Nosai Hullu.

It is a slender grass growing to 1½′ high. It occurs mostly in dry and poor soils in the forests. Cattle graze this readily but the quantity of forage is not much, the leaves being minute and the stems slender.

49. *Eragrostis brachyphylla*, Stapf.

Tel : Nakka Piththu Kasuvu.

The habit and the characteristics of this grass are similar to those of *Eragrostis bifaria*, Wt.

50. *Oropetium Thomaeum*, Trin.

It is a dwarf grass growing to about 3″ in height forming tussocks. It occurs in dry localities. The spikes are longer than the stems. It is too short for cattle to graze.

51. *Enteropogen monostachyos*, K. Schum. (*Enteropogon melicoides*, Nees.)

Tam : Kannai Pullu.

It is a tall grass growing to 3′ in height. It thrives in dry forest regions. It is easily grown in the plains. It is found on analysis that it has very high nutritive value. It is one of the good fodder grasses giving an aggregate acre yield of 17,840 lbs. of green fodder in three cuttings at the Central Farm, Coimbatore. This grass should be introduced into forest regions where it is absent.

52. *Cynodon Dactylon*, Pers. (The common Hariali)

Tel : Gericha Geddi. Kan : Kudi Garikai. Tam : Arugam Pullu.

It grows to 1′ high and is one of the best pasture grasses. It makes excellent lawns. The fodder is much relished by horses. It spreads by underground stems. It is a pernicious weed in arable land and is eradicated at great expense.

53. *Cynodon Barberi*, Rang. & Tad.

Tel : Sanna Ootla Kasuvu. Kan : Mel Garika Hullu.

It grows to 9″ high and is one of the chief pasture grasses of this district. The fodder is much relished by cattle, and is often mistaken for "Hariali" from which it differs mainly in the absence of underground stems.

54. *Chloris incompleta*, Roth.

Tel : Kanthari Gaddi. Kan : Melamalai Hullu.

It grows to 1½′ in height and occurs under shade in the forests. It is not considered a good fodder grass; however cattle nible it before flowering.

55 *Chloris barbata*, Sw.

Tel : Uppu Gaddi. Kan : Hennu Manchada Kalu Hullu. Tam : Kuruttu Pullu.

It grows to 1½′ in height and is found everywhere except in dry and rocky soils. It is good fodder grass. It is one of the few grasses that thrives in alkaline soils.

56. *Dactyloctenium aegyptium*, Beauv. (*Eleusine aegyptiaca*, Desf.)

It is an annual creeping on the ground and rooting at the basal nodes. It is a common grass mainly found in the pastures and in standing crops. It does not thrive in dry and rocky soils. Cattle graze this readily.

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Fungus diseases—How they affect the wealth of the Madras Presidency.*

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Freedom from diseases is a *sine qua non* in the culture of plants. Each crop is susceptible to a particular disease or diseases. In our Presidency losses of different crops caused by diseases have not been determined with any degree of accuracy. Estimates made, go to show that they vary from 15 to 90% per year.

In most countries measures are taken to investigate diseases as they appear and to eradicate them or prevent their spread. These diseases are of various kinds differing in virulence, method of spread and response to control methods. To combat diseases a huge army of workers has become necessary and legislation has been resorted to in certain cases to reduce the incidence even if total extermination has not been possible.

Measures adopted have varied from country to country and the degree of perfection reached depends on the personal efficiency of the staff. International cooperation is necessary as otherwise minor diseases of one country may develop into serious ones when introduced into another. There are however limitations to our exertions in this respect as the spores of certain fungi are carried over long distances and great heights and thus pass from one country to another. Mehta has shown that in the case of the rust of wheat, spores are carried by wind from the hills to the plains of India.

Biological control is one of most promising lines of attack of the problem. Other steps that are necessary in this direction are :—

(a) Plant disease surveys
(b) Intensive study of diseases
(c) Issue of health certificates
(d) Port Inspection and Quarantine
(e) Insurance (Crop)
and (f) Legislation.

Each of these has definite limitations. Plant disease surveys provide reliable data of the distribution and periodicity of diseases in a country and this information can be made use of by the farmer to adopt control measures if there are any, in time. A knowledge of the causal organism, varieties of crop plants affected and how the organism continues from year to year and such other important data can be gained only by an intensive study of the diseases. This knowledge is essential to devise measures of control. A system of issuing health certificate over the signature of an authorised agent

* Summary of the Curzon lecture delivered at the Agr. College, Coimbatore under the auspices of the Madras University.

of the country of export has come into vogue. It has its own defects but it is a rough and ready method of keeping out diseases. If this is coupled with a system of inspection at the port of entry and keeping in quarantine suspicious articles, it might be possible to check introduction of new diseases with the host plants imported. This may be costly to the importer and may involve administrative difficulties. Crop insurance is likely to prove beneficial to the grower, but has not been seriously suggested or taken up and may be difficult of adoption. Legislation can deal with various aspects from the time of sowing the crop plants till the products reach the consumer but its success depends upon several factors like the literacy of the cultivator, the cooperation of other agencies and the sympathetic handling of the administrator.

Next I shall take the various crops of the presidency and their common diseases.

Paddy. By far the most serious disease of paddy in this presidency is " blast " caused by *Piricularia oryzae.* It has been recorded from all rice growing countries of the world and in Madras it was first reported in 1918 from Tanjore. The outbreak of the disease is linked up with the weather conditions prevailing during the cropping period of paddy. A warm humid atmosphere helps the development and rapid spread of the disease. The disease starts as brown spots in the leaves and under favourable conditions the whole earhead gets chaffy or the neck of the earhead breaks. The loss is more if the attack is early and less if it is late On the Central Agricultural Station, Coimbatore, the loss due to this disease on Korangusamba in the year 1927 ranged from 70 to 90%. Spores of the fungus are viable up to a period of 6 months and this is sufficient to bridge over the off season. The mycelium is present in all parts of the plant. Besides paddy this fungus infects wheat, barley and oats.

The disease is not amenable to direct treatment. Excess of nitrogenous manure predisposes the plants to this disease. Different varieties of paddy vary in their susceptibility to this disease and the chief venue of disease control therefore lies in the utilisation of disease resistant varieties.

Helminthosporium oryzae is not a very severe parasite on paddy and attacks the plant when in a weakened condition. Small brown spots form on the leaves, and the nodes, neck and grains blacken Earheads may not emerge. Disinfection of seed, destruction of infected stubble and clean cultivation reduce the amount of loss.

The foot-rot of paddy causes heavy damage to seedlings. The stalks elongate, large numbers of adventitious roots spring from the lower nodes and the earheads if formed become chaffy. Steeping seed in copper sulphate solution or dusting with ceresan has given beneficial results.

Another minor ailment is the sclerotial disease, which causes the formation of numerous green shoots at the base which turn yellow and die.

Empty glumes and poor development of grains result. This may be controlled by growing disease resistant strains, removal of infected plants and thin planting of seedlings.

Cholam. Smuts, rusts and leaf shredding disease are the important diseases of this crop.

Short-smut. Affected grain is bigger than the normal grain, is covered by a light brown skin and is filled with a black powder. The damage is considerable.

Remedies. Treat the seed. Steep the seed in copper sulphate solution or subject it to a treatment with very fine sulphur.

On other cereals and pulses, little work has been done so far.

Chillies. Die-back and fruit-rot.

Leaves of young plants fall off. Young branches die back and are bare of leaves. Small black spots are seen on fruits when rotten.

Remedies. Spray early in the season. After harvest remove all plants in a diseased field and burn. Do not plant again for another two seasons. Do not use infected seed and avoid solanaceous crops.

Ginger. This is an important commercial crop which suffers fron leaf-spot disease and soft-rot.

Leaf-spot. Light yellow spots occur on both surfaces of leaves, and the portions affected dry up, forming holes. Some times entire leaf is attacked.

Remedies. A spraying or two as necessary and using healthy rhizomes.

Soft-rot. Paleness of leaves of the shoot followed by yellowing of the tips of leaves. Sudden withering of leaves and shoot and rotting of rhizome.

Remedies. Reject diseased rhizomes.

Turmeric is chiefly grown in Guntur, Cuddapah, Vizagapatam and Coimbatore and suffers from leaf-spot and rhizome rot. Yellow spots form on leaves which increase in size and dry up. In the dried up portions of leaves small black spots appear. Later the infection spreads to the rhizomes.

Remedies. Spray with Bordeaux mixture in the early stages of attack. Secure healthy seed for sowing.

Betelvine. It suffers from wilt caused by the fungi *Phytophthora parasitica* and *Sclerotium rolfsfi* When the former disease attacks the vines, leaves suddenly lose their turgidity, become flaccid, droop, turn yellow and the plant dries up in the course of a week or less. Dark water-soaked spots which get softened are found in the collar region of a dying vine. In the latter fungus, the presence of a thick white weft of mycelium enveloping the base of the plant is characteristic, resulting in the rapid rotting of affected portions of the stem and its shredding and eventual death of the plant.

Remedies. Rotate the crop with paddy and sugarcane and drain the land very well. Spray with Bordeaux mixture at the base and adopt clean cultivation.

Sugarcane. In this presidency this crop is chiefly subject to three maladies, red-rot, smut and mosaic.

Red-rot is known all over the world wherever sugarcane is grown. The characteristic symptom of this disease is the reddening of the internal tissue and then the cane withers and dries up. The quality of the juice gets deteriorated and very poor quality of jaggery is produced. The disease is spread to a large extent by planting diseased setts. The seed used for planting should be free from disease and this is best done by selecting setts from uninfected stools.

Mosaic. The disease is characterised by a peculiar mottling of the leaves. From a distance a badly infected field shows a dull green or yellowish tint instead of healthy dark green colour. On the leaf surface innumerable whitish or yellowish elongated patches appear. In some highly susceptible varieties the stem gets shrunk and the rind cracks. Mosaic may rightly be described as a wasting disease which does not kill the cane outright but causes material reduction in the tonnage of cane per acre. Some varieties like Red Mauritius, Java Hebbal and B 208 are susceptible varieties. The loss from mosaic has been estimated to be up to 40% in Porto Rico and 50% in Hawaii. Planting of setts from mosaic-free clumps, (2) systematic weeding of infected stools and (3) planting of resistant varieties keep this disease in check.

Smut. Affected plants are distinguished by the formation of a long whip-like dusty black shoot from the growing shoot covered by a thin membrane which ruptures and exposes the spores. The spores are blown about by the wind and healthy plants are infected. The fungus grows within the plant for a period and then affects the shoots when in the place of the growing spindle a long whip-like structure is formed.

Remedies. Since infection takes place through young shoots or eyebuds or a wound on the stem, seed treatment will not prevent the disease. A smutted plant can never recover but acts as source of infection to other healthy plants. Prompt removal and burning of the affected clumps are essential.

The Palms. *Palmyra bud-rot.* The bud-rot of palmyras and coconuts has been proved to be the result of an attack of a fungus *Phytophthora palmivora.* It is a severe epidemic disease of the palmyra palms in the Godavari and Kistna districts and Malabar. The first signs that a palmyra is diseased are (1) the central expanding leaf turns yellow and dries up or (2) rows of diseased spots are seen on the expanding leaves. When the central leaf dies, the growing point at the base dies. Soft rot sets in, which causes the leaf tissue surrounding the growing point to become soft and

rotten. The expanded leaves one after another wither, die and fall off. When the lower sheaths are cut off, brown spots are seen on the leaf blades, leaf sheaths and spathes.

Remedies. If the bud is not dead, but diseased spots are found on the leaves, all the affected leaves and leaf sheaths should be stripped. If the bud is dead, the crown should be cut, split up into pieces and burnt.

Coconut bud-rot. The disease was first noticed in Malabar in 1912 and as a result of the supervision of the department kept in check when the usual operations for checking the disease were discontinued. Since then the disease has recurred and control measures have been adopted. The agricultural officers in the locality attend to it so that the disease is kept in check. The operation undertaken to reduce it consisted in cutting and burning the heads of dead palms and examination of the trees within 50 yards of the dead tree and operating those found to be affected. In tracts where the disease was bad the trees within a belt of 50 yards were examined.

Bleeding disease of coconuts. The presence of this disease is shown by a red viscous fluid oozing out from the stem of the tree. Trees gradually deteriorate and die. The control method consists in cutting out the affected part entirely, burning the wound with a lighted torch and then painting the cut surface of the wound with hot tar. In this way the disease can be exterminated. It is common througout all the coconut area in this presidency and especially it is very bad in places where the drainage is defective and the soil is alkaline.

'Mahali' or fruit rot and nut fall of arecanuts. The disease attacks young fruits and spreads rapidly during the monsoon by means of spores spread by wind and rain. The effect of the fungus is to cause the young fruits to rot on the bunches and drop down. If the attack is severe, major portion of the crop is lost. The treatment consists in spraying the bunches with Bordeaux mixture so as to give it a protective covering. This is done by means of a small spraying machine costing about Rs. 25. The ingredients for the mixture are cheap and simple and can be easily had from any bazaar and the cost of spraying 100 trees comes to about a rupee.

In arecanut gardens badly affected by 'mahali' disease coconuts were found to drop from trees showing symptoms similar to the rotting of arecanuts and with the same fungus on them. The arecanut disease fungus which was inoculated on coconuts produced same symptoms of rotting. The garden owners were advised to spray the coconut bunches, when they spray the arecanuts.

Fruits. *Grape-vine mildew.* The disease causes the fruits to rot which results in complete loss of crop in bad years. The result of spraying with Bordeaux mixture has been successful.

Spraying has become so popular that the entire area is now being sprayed. The garden owners purchase sprayers and chemicals themselves and spray all their vines themselves and every garden is now bearing heavily.

Plantain. The only disease of a very serious nature from which the plant suffers is what is known as 'Panama' disease or plantain wilt. The fungus lives in the soil and attacks the plant underground through the roots and rhizomes. Older leaves turn yellow from the margin or develop yellow spots and dry up. In course of time, younger leaves also follow suit. In some cases, green leaves droop and break down, Often outer leaf sheaths also split. Bunches are rarely formed and when formed show signs of arrested development.

Remedies. Select suckers from disease-free localities, and attend to drainage.

To sum up, the various remedial measures detailed above may be classified under one or the other of the following heads :—

1. Plant protection (a) spraying (b) seed disinfection
2. Resistant varieties.
3. Field sanitation.
4. Rotation of crops.
5. Quarantine regulations.

Unless these measures are resorted to, no one can hope to expect an annual yield of thousand millions tons of plant matter which is the minimum, if this presidency is not to suffer from scarcity. In this connection, I should while concluding, sound a note of warning to those who rely on breeding alone for adequate yields. Plant breeders should beware of the crops' worst enemy "susceptibility to fungus attack". Any slight neglect of this most essential aspect is sure to land the breeder in utter failure, years of labour, energy and evolution of hundreds of strains notwithstanding. The lessons to be learned from the effects of red rot of sugarcane and blast of paddy should prove as sufficient warning. What matters it if you can show an increase of yield of 10% over control when the damage caused by disease ranges from 20 to 80%.

Some Experiences of the Varying Response of Different Millets and Cotton Strains to Local Areas in Cuddapah and Kurnool Districts.

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In recent times the study of plant life in relation to their environment is given greater prominence on account of its important and economic bearing in practical agriculture. In this branch of science called plant ecology, the influence of the various factors like light, temperature, water, physical, chemical and micro-biological properties of the soil on the developmental phases of different plants, are intensely studied. It is, during the course of these studies that the terms "eco-types" and "eco-species" are employed to varieties of plants or cultivated crops which are considered as products arising through the sorting and controlling effect of the "habitat factors upon the heterogenous species population." Turesson proposed these terms with a view to maintaining a distinction between ecological and genetical units. Du Reitz while attempting to define sub-species and variety, wrote that the former is a population of one or several bio-types forming a more or less distinct local facies of a species. To draw a clear criterion is difficult; and an attempt is made in this paper of enumerating the experiences in testing the yield trials of the several strains of millets and cotton evolved at the Agricultural Research Station, Nandyal, in the several taluks of Cuddapah and Kurnool Districts where intense variations in soil fertility and other environmental factors are observed.

While discussing the "Problem of Cereal yield" in the world's Grain Exhibition and Conference, Canada in 1933 F. L. Engledow enumerates the two types of factors controlling yield. The first is the internal factors which belong to the plant and the second, the external factors which are the factors of the environment in its widest sense. According to him, there is a subtle inter-play between these internal and external factors and in agriculture each type has no absolute significance but must be conceived and measured in terms of the other. The environmental factors are usually associated with soil, climate and husbandry and the producer has very limited control over them. It is, in these respects that he has to adjust his methods by scientific aid.

In the two districts of Cuddapah and Kurnool, a detailed examination of the existing agronomic practices reveal that apart from the common

essential principles underlying this system of cultivation, there exist many differences in the several agronomic aspects of raising crops, mainly due to soil and environmental variations. The several modifications of agricultural practices adopted in these two districts with special reference to cultural operations, time of sowing, spacing, seed rate, rotation and other factors form an interesting subject of study to the agronomist.

It is not possible within the limited space of this paper to enumerate instances of the various modified agronomic practices and their relation to the changes in environmental conditions. In the Nandyal Valley seed drills with tynes $10\frac{1}{2}''$ and 18" apart are used for sorghum and cotton sowings respectively, while in Proddatur and parts of Jammalamadugu the $10\frac{1}{2}''$ tyned drills are used for both the crops. The sowings of these crops commence rather early in August in Allagadda and Proddatur taluks, where the rainfall is less, while they extend to September in Nandyal taluk. In Atmakur taluk sorghum is sown late in the season by about the first week of October when the rains practically cease. In a similar manner the varieties of millets grown differ markedly in their composition. Pithy stemmed varieties of sorghum are preferred in the Cuddapah district and in parts of Allagadda, while the sweet-stemmed ones are popular in the Kurnool district. These varieties differ to a considerable degree in duration, panicle shape, grain colour and size from tract to tract.

From 1935 onwards regular trials of sorghum, cotton and *korra* crops were conducted with about half a dozen strains in each crop in the different taluks of the two districts. The lay out in all the cases was in randomised blocks with suitable replications. A preliminary note on the response of these strains to local areas, based on the results of the first year was published*. The results indicated the variations in the yields due to changes in environmental conditions. The differential response of the several strains at the different centres and in the same centre was quite evident. The difficulty of securing a cosmopolitan strain to satisfy the requirement of the entire area, was apparent from the results, which exhibited wide variations in the cropping power of these soils. The necessity to conduct larger number of trials, scattered over as wide a range of area as possible, was realised.

The trials were continued in about ten district-work centres for each of these crops in Cuddapah and Kurnool districts consecutively for three seasons. The results were in accordance with the findings of the first year's experiences. Full particulars and summaries of these trials are furnished in this Station's Annual Reports for 1935—36, 1936--37 and 1937—38 It is not possible to recount in detail the experiences of each of these trials in this short paper. But, however, judging from the results of these trials for three seasons the following information is obtained.

Sorghum. (*Jonna or Cholam*). In the non-sweet stemmed area comprising all the taluks of the Cuddapah district and portions of Allagadda,

* *Mad. Agr. Jour.* Vol XXIV : 184—185.

strains 223 and 224 in sorghum have given good yield varying from 10 to 25 per cent increase over the local. These are pithy stemmed varieties and appear to be suitable in Proddatur, Cuddapah and portions of Allagadda taluks. Among the sweet stemmed varieties in this area, strains 28/3 and 29/68 have given better yields than local in some places while in other localities they are equal to local in their performance.

In the sweet stemmed area comprising the taluks of Kurnool District, N. 28/3 sorghum has given good yields in the majority of trials. This strain is characterised by medium sized grain with dull yellow colour and it seems to be well adopted to soils of medium and poor fertility, the increase in yield ranging in some of the localities from 10 to 15 per cent. At the Agricultural Research Station, Nandyal, this strain has given consistently high yields in all the trials for the last four seasons and this is now being multiplied in the several district work centres for distribution to ryots. In Koilkuntla and Nandyal taluks, N. 29/68 commands greater favour on account of its bold grain with lustrous yellow colour. It thrives well in soils of good and medium fertility and this strain is now being distributed in such areas in the Nandyal valley.

Italian Millet. (*Setaria italica*). *Korra or Tenai.* In the *Korra* crop, strain 132 has given good yields in the trials, the increase over local ranging from 15 to 30 per cent in Kurnool, Koilkuntla and portions of Nandyal and Allagadda. Strains 140 and 125 find favour in Rajampet, Cuddapah, Proddatur and portions of Nandyal taluk. These sirains have long compact panicles, good setting to the very base, absence of tip sterility and good tillering capacity. Strain 132 has given a maximum yield of 1,200 lb. under rainfed conditions in Nandyal valley and 2,000 lb. under irrigation in Rajampet taluk. These strains are now being multiplied and distributed in the respective centres.

Cotton. The cotton sirains N. 23 and N. 29 have given good yields in the Cumbum area, the percentage of increase over N. 14 ranging from 15 to 20 per cent. Strain N. 14 in the Nandyal valley has a steady performance in select areas. In many trials it is equal in yield to local and produces superior lint. The "local" which is a mixture of indicums and herbaceums shows wide variations in yield of kapas due to seasonal influence and hence is not reliable. Besides, its quality is inferior and fetches a low price in the market; while N. 14—a steady performer noted for its high staple strength and spinning value, finds a ready sale at a higher price, at 25 to 30 per cent more than the locals Efforts are now being made to raise adequate areas under seed farms with a view to meet the large demand for this seed in Nandyal valley.

Apart from these trials in districts, two more sets of trials were conducted by the station staff last season in typical villages in the vicinity of the Agricultural Research Station, Nandyal. They are, (1) Zone classification trials and (2) the Cropping power trials.

(1) *Zone Classification Trials.* The object of these trials is to verify whether there exist in this tract definitely different zones of soils naturally formed which do not permit interchangeability of seed from one zone to another in sorghum crop, as is popularly believed. For this purpose mass selected seed from these well defined zones was gathered and trials conducted in each of these centres.

Out of the fives trials conducted, the varietal differences are significant in four cases. At Kanala, the mass selected seed of the four zones is better than the local. At Ayyalur and Parnapalle, the mass selected seed from Balapanur tract has given better yields while the others are equal to local. The results on the farm are consistent with those of the previous year, strain 28/3 giving the highest yield. The popular prejudice against interchangeability of seed from tract to tract is thus partly true.

(2) *Cropping Power Trials.* These trials were conducted in villages in the vicinity of the farm with a view to find out the cropping power of these soils with respect to the several types of sorghum strains. Of the four, the varietal differences are significant in one case. Strain N. 2803 has given uniformly good yields in all the localities. The variation in the yields of the respective locals in these trials clearly brings out the cropping powers of these soils, as judged by the results of these trials.

SELECTED ARTICLE

Soil Erosion in India.

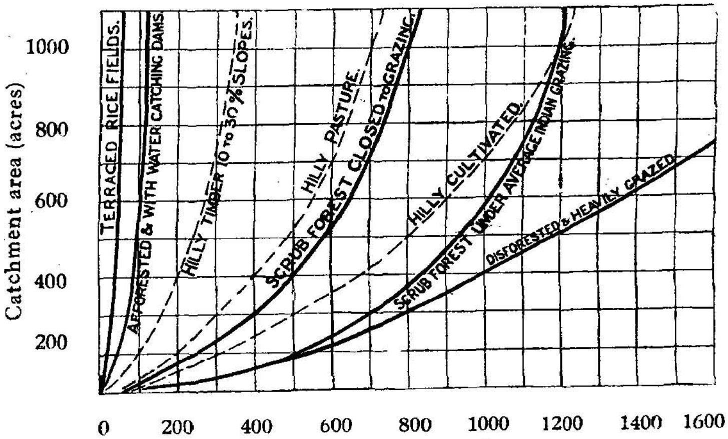
By Dr. R. MACLAGAN GORRIE

Contrasts with American Data.. Erosion losses are less where the rainfall is well distributed, and it is now commonly recognized that erosion has most serious consequences in arid tracts. A heavy monsoon has more effect upon sloping fields than it has on neighbouring grasslands, whereas in arid climates the smaller area of fields is more carefully terraced, but the neighbouring grazing grounds are more vulnerable to infrequent but heavy downpours. This may serve to explain an anomaly that occurs in run-off intensity data. American figures worked out by Ramser and frequently quoted show the following averages in cubic feet per second per square mile, and in contrast I also quote tentative data of the same sort for Indian conditions.

Run-off in cubic feet per second per square mile.

America.	Cusecs.	*Punjab.*	Cusecs
Hilly timber, 10—30% slope	300	Terraced rice fields	50
" pasture, 10—30% slope	620	Foothills afforested and with soil-catching small dams ...	120
" cultivated 10—30% slope	1040	Foothills scrub forest closed to grazing	700
		Foothills open to grazing ...	1100
		Foothills disforested and heavily grazed	1600

The American farmer using a motor-tractor keeps his fields large, and so the run-off from broad slopes of bare plough land is greater than from his paddocks of comparatively well clothed pastures. This also applies to Canadian and Australian average conditions and to parts of South Africa. On the other hand, the Indian peasant farmers have their fields in tiny and often well-terraced units which catch and hold the rain-fall, whereas their grazing grounds are so misused and so badly protected with a mutilated plant cover that the run-off from them is far heavier. In the African dependencies, according to Sir Frank Stockdale's statement at a meeting of colonial officers held in Oxford in June 1937, "agricultural activity was as frequently to blame for erosion as overstocking with livestock," so probably their run-off figures would be equally heavy for cropped land as for grazed land. Reliable data for run-off and erosion, and also for rainfall intensities and storm behaviour, are lamentably scarce even for our most important catchments, and a great field of work awaits the next generation of colonial research workers.



Comparative run-off for American and Punjab conditions.

American data from C. E. Ramser's curves (broken lines). Indian data from Pabbi Hills torrent measurements by Irrigation Branch (full lines).

Rainfall and River Behaviour. Mr. E. G. Bilham's paper on "Weather and Water-Supply" read at the Public Works Congress, 1937, directs attention to the fact that even in Great Britain very few attempts have so far been made to correlate the loss of rainfall by evaporation, surface run-off, and seepage with the behaviour of streams. More work is required upon the actual fate of all the rain that falls upon a given type of plant cover and the contribution which this cover makes to the nearest stream in terms of surface and ground-water flow, before we can discuss intelligently the reactions of the larger rivers.

A study of the Ravi River flow records for the last twenty-five years carried out by the staff of the Punjab Irrigation Research Institute shows no significant indication of any gradual increase in number or intensity of floods nor any direct correlation of heavy floods with heavy rain. This is presumably owing to the fact that the heaviest floods arise from heavy snow-melt in the high inner hills, combining with a series of downpours falling on eroded ground in the foothills. The figures of winter flow do, however, indicate a continued deterioration in supplies available for winter irrigation. It is scarcely to be expected that a simple phenomenon such as the run-off of rain can be correlated exactly

with the highly complex phenomena which go to make up the stream-flow of a large river. The Ravi River's catchment of nearly 15.000 square miles varies from 2,000 ft. to 20,000 ft. in altitude and contains several recognizable meteorological zones, so instead of looking for any correlation between rainfall and run-off for the whole, it would be better to study small individual sections and find out how each tributary reacts to the rain and snow which fall within its catchment. Unfortunately, the rainfall data in this case are for only one rain gauge for the 15,000 square mile.

New Indian Statistics of Erosion Losses. Reliable run-off figures for forest and grassland are now available for the first time for Indian conditions. A technique of volumetric analysis of water and silt was worked out by the Punjab Irrigation Research staff at Madhopur in 1935 for a type of small isolated plot of undisturbed soil 3½ sq. ft. in area, and this method has since been followed in forest plots at Nurpur in Kangra district. A battery of six plots gave three pairs namely, (i) grass, (ii) grass and shrubs, and (iii) bare soil, on a slope of 1 in 4 on an eroded hillside of poor Siwalik sandstone. The grass cover over all is distinctly poor, as it is recovering slowly from previous heavy grazing. The bare plots contain a little grass which has been kept clipped back with scissors. They thus simulate local grazing conditions to some extent, though we have not reproduced the destructive trampling action of cattle scrambling on a grassy hill-side; and the run-off from grazed areas must therefore be considerably heavier than the figures now reported.

The results of the first monsoon's catch are as follows:—

Percentage of rain which ran off:	Grass 80% cover.	Grass and shrubs 90% cover.	Bare soil, grass clipped every 3 days.
Out of total of 46 in 32 wet days during July—October 1937	7	5	25
Out of total of 5¼ in. in 4 hours, the heaviest single storm	2·2	1·7	6
Weight of soil lost per acre:			
Carried away on 32 wet days ...	35,000 lb.	3,900 lb.	18,500 lb.
Carried away by a single storm (5¼ in. rain) ...	260 lb.	307 lb.	3,511 lb.

These figures give one food for thought when it is realized that in a single storm the uncovered plots lost soil at the rate of 1½ tons per acre. This may be taken as a typical figure for all bare fallow fields in the foot-hills of northern India except properly levelled rice land, and they are definitely conservative for the average village grazing lands which suffer from trampling of cattle. The ordinary grazing lands also suffer from the accumulative action of shallow gullies cutting the surface on long slopes, a phase of erosion which is of course not reproduced in our square plots.

Measurements reported from the Bombay Dry Farming Research Station at Sholapur (chief investigator, Mr. N. V. Kanitkar) show a loss of 115 tons of soil per acre per annum from a field of jowar, (A. Sorghum) which is the most important combined grain and fodder crop in the Bombay Daccan. This loss was caused in a properly cultivated plot as a result of two very intense storms of 3·5 in. and 4·3 in. The total rainfall of 28 inches is usually fairly well distributed and no such intense storms occurred during the previous year when measurements were started. The silt lost in these intense storms was particularly rich in valuable plant foods such as lime and potash, which were stolen by erosion, leaving the remaining soil much poorer. Of the various other kinds of plant cover tested, the amount of water lost in the run-off was not strikingly different where weed

or crop cover was dense. The amount of soil lost where the weeds had been reserved in fallow was just one two hundredths of the jowar plot, while the clean fallow of bare but uncultivated ground yielded 25 tons of soil per acre or 22 per cent. of the jowar plot's loss. These astonishingly heavy losses of silt were from very gently sloping ground, the average slope being 1¼ per cent. or 1 in 80, and the data are entirely reliable, having been collected from thoroughly isolated plots. I am indebted to Mr. Kanitkar and Dr. W. Burns for permission to use these figures.

The point which this experiment has brought out is that, under Indian conditions, good cultivation on even a slight slope is no better than bad cultivation for saving soil, unless it is protected by some form of contour ridging. The only sure way of reducing soil losses during exceptionally heavy storms is by contour ridging which is sufficiently deep to render each field a more or less self-contained catchment unit, so that cumulative run-off from a series of fields is prevented. The necessity for such protection is brought out by subsequent figures for these same plots in 1937, so far unpublished but furnished in a letter from Mr. N. V. Kanitkar who reports that this same jowar plot has lost a total in the year of 133 tons per acre. This included one storm in which 2·13 in. of rain in half an hour removed the huge amount of 52 tons of silt per acre.

(*Nature*, Volume 142, No. 3595.)

EXTRACTS

THE DUST BOWL CAN BE SAVED

In the Autumn of 1935, I travelled the length and breadth of the dust bowl—an area more than twice as large as all New England, embracing parts of the five Southwestern states. Even on days of low wind velocity, I saw banners of gray dust playing across fields as barren as the moon. Much of the crop land was so badly drifted that some soil experts doubted it would ever produce again.

Today the dust bowl still exists, but it has shrunk. Last autumn I followed the roads I drove over in 1935, and found the land miraculously dotted with lush green fields of drought-resistant crops—milo, Sudan, maize, broom corn. Near Dalhart, Texas, where two years ago the wind had piled up sand dunes 30 feet high, hardly a spot of bare sand was left exposed. Right up the slopes of the dunes, which are now only eight or ten feet high, grew a healthy stand of corn. Shortly before, roasting ears had been plucked from stalks six feet tall.

This dramatic triumph of agricultural science is part of an amazing demonstration that proves the dust bowl can be saved. Two years ago the Department of Agriculture's Soil Conservation Service leased for experiment a 900 acre tract near Dalhart. The first step was to anchor the lands around the dunes with tough, drought-defying cover crops. Then during the winter and spring seasons of high winds the tops of the ridges were loosened with tillage implements. Day after day the wind scoured off the sand and deposited it in a thin layer out through the surrounding stubble. During the growing season corn was planted on the dunes to protect the adjacent areas of maize. A few more years of this program and the entire 900 acre tract probably will be as level as a floor.

A more significant phase of the work has been the reclamation of thousands of acres of crop land that had been wrinkled up into low hummocks of silt and sand. Recently, with the assistance of the Soil Conservation Service, the farmers have knocked down the hummocks with road graders, conserved every drop of rainfall by careful tillage, and planted crops that would anchor the soil. As a result, last fall I saw first-rate crops of sorghum, Sudan and broom corn on hundreds of such fields, which two years ago were among the millions of acres that

soil experts had labelled "destroyed". The relatively virgin soils of the dust bowl are exhibiting an astonishing resiliency.

The Government's program of improved farming has three basic points: conservation of moisture, the consistent use of cover crops, and a cessation of the disastrous practice of planting wheat in a dry seedbed.

Rain in the dust bowl often comes in severe bursts, and although the land seems level, it usually slopes enough so that the water runs off quickly. Contour farming is stopping this. Guide lines are run by engineers through the fields—each line on a level, across the slope of the land—and the fields are then plowed accordingly. Instead of running off, rain water cascades into the furrows, backs up and sinks into the soil. Broad, low terraces also are thrown across the fields, to catch water which escapes the furrows. They are so low, their slopes so gradual, that crops are grown upon them; and properly farmed, they last for ever.

The Soil Conservation Service has blocked out 13 large demonstrational projects on lands that are privately owned; farmers come into the scheme voluntarily and continue to do their own farming, but in accordance with the Soil Conservation plan. The government performs certain tasks for them, such as the building of terraces.

At Liberal, Kansas, I talked with one of these farmers. One of his fields, of 320 acres, was terraced; it yielded 17½ bushels of wheat to the acre. His remaining 530 acres, farmed in the conventional way, yielded only nine bushels per acre. My notebook is full of similar convincing testimony.

Moisture conservation alone will not save the dust bowl. In great drought the subsoil is parched far below the root growth. If a farmer makes his fall sowing of wheat then, the chances are that his fields will blow away in the spring.

So, about two years ago, government research men went to work on this problem and painstakingly charted many years' records of yields, precipitation and subsoil moisture. They found that unless there is 24 inches of subsoil moisture at seeding time the wheat crop will be a failure, leaving the fields unprotected against wind erosion. They demonstrated that all a farmer need do is to test his fields in the fall with a soil auger, and from the amount of moisture he finds he can predict accurately his chances of making a harvest nine months later.

"If all our farmers would plant cover crops when there isn't enough subsoil moisture for wheat," said Ray Throckmorton, chief agronomist at Kansas State Agricultural College, "it wouldn't be so hard to stop the black blizzards. But it is tough to ask a wheat farmer—particularly one who is already busted flat—to stay out of wheat and protect his land".

Perhaps the best cover crop is the dwarflike, knee-high milo now being grown on the southern high plains. Ten years ago there was nothing much to plant but the tall kaffirs and milos, natives of lower altitudes, which were hammered down by the winds and killed by the fierce summer sun. After years of careful work, J. B. Sieglinger, plant breeder of Oklahoma, produced a stout variety of milo which withstands prairie winds and sun; it produces a full fat head of grain and can be harvested with wheat combines. This year there were hundreds of thousands of acres of Sieglinger's milo in the dust bowl, produce in many cases on less than 10 inches of rainfall.

In spite of all this new knowledge, I saw, even last fall wheat drills going in hundreds of powdery fields, where subsoil moisture is completely exhausted. Next spring many of those fields will "go to hell in a handbasket" as they say locally carrying adjacent lands with them.

The farmers know this in a haphazard way, but the land of big wheat has always been gambler's country. Even today, some of the big growers are looking forward to a return of the lush years when they harvested and sowed and went to California for the winter. Mere campers on the land, they don't want to be tied down by diversified farming.

Moreover, it takes money to change the character of farming throughout a whole region, and the dust-bowl farmer is broke. The more extensive use of cover crops implies the raising of livestock to make use of the fodder — and that takes capital to get started. Even contour farming costs from six to ten percent more than conventional methods. The wheat drills I saw rolling along in choking dust last autumn were run, in many cases, by men who, unable to afford a change in farming methods, were making a last desperate gamble. Government men are hopping for enough funds to remove, by outright purchase, the most hazardous soils from such mistaken efforts.

About a year ago there sat in my office a brisk traveller from a blow country 110 000 miles away. He was E. S. Clayton, chief experimentalist of the Australian Department of Agriculture. Australia has red blizzards that roll out of the arid interior, fog down into the coastal cities and sometimes stain the air for hundreds of miles out across the Tasman Sea.

So serious has wind erosion become that in some localities the vast sheep industry is threatened with ruin, and many wheat growers in the once rich Mallee lands are about at the end of their tether. Mr. Clayton was circling the earth studying control methods in other countries. " You Americans," he said " are doing very effective work in your dust bowl. I wish we had made as good a start in Australia."—(*Readers Digest*, February 1938).

Agricultural Jottings.

(From the Director of Agriculture, Madras.)

IMPORTANCE OF HEAVY MANURING FOR PADDY NURSERY

Paddy nurseries occupy roughly one-tenth of the area under paddy crop in all tracts where transplanting is practised. These are of ten different sites selected for *Kuruvai* and the subsequent *samba* and second crop nurseries. In all cases the nursery is no doubt slightly better manured than the planted paddy crops. But after removal of the thickly sown seedlings, the yield of the paddy planted in the nursery is not such as to compensate the cultivation expenses, and so very often, the nursery area is neglected if not abandoned. This is more often noticed in the case of *samba* and second crop nurseries. It is not in the interest of the country to waste such a large extent as a tenth of the area under paddy cultivation.

The following instance of how paddy land has not only been improved by manuring, but has consistently been able to raise 3 crops of seedlings each year—*kuruvai*, *samba* and *thaladi* or second crop—and still keep up a very high yield of paddy will convince the paddy farmer, how he should look after his nursery and increase his return. Field No. 68-B is a bit of wetland in the centre of the paddy lands of the Palur Agricultural Research Station. When this station was acquired about 1907-8, this plot gave an acre yield of only 927 lbs. By the application of green manuring mainly *daincha*, it was possible to increase the yield during the next 10 years to 2,750 lbs. per acre, and two such crops were later raised in the same field giving upto 5,500 lbs. per acre. After bringing this field to this state of fertility it was decided to convert this plot as a paddy nursery of which

the first was raised in 1921. With proper manuring with green leaf and reduction of seed rate to one Madras measure of paddy per cent. of nursery, the seedlings were exceedingly healthy and single planting was easily possible. Seven cents were found sufficient to plant an acre, thus reducing the area required for nursery from $\frac{1}{10}$ to $\frac{1}{14}$ of the total area under paddy. After the removal of seedlings two crops of paddy were raised and later two nurseries and a paddy crop were raised. This system continued for 10 years and during this period 20 nurseries and 11 paddy crops were raised and the average yield of paddy after 2 nurseries each year was 2,711 lbs. per acre. A further intensive treatment was started afterwards and during the last eight years three nurseries (1) *Kuruvai* (2) *Samba* (3) *Second* crop samba were raised, one following the other and after the removal of the third batch of seedlings, a late variety, viz. Poombalai was planted and it is satisfactory to note that the yield of paddy has risen still further giving an annual average of 2,955 lbs per acre, which is higher than the farm average yield of *samba* for the same period.

The system of manuring adopted is this. After thorough puddling of the nursery, 5 to 10 cartloads of outside leaf is trampled and the seed sown at 1 M. M. per cent. If for any reason the seedling does not appear healthy a dressing of ammonium sulphate is given at 1 lb. per cent. The planted paddy crop is given about ¾ candy groundnut cake or 2 cwts. (1 full bag) bonemeal per acre. It will thus be noted that with a much smaller area of nursery, well treated, we can get healthy seedlings for single planting and also raise a very good paddy crop.

The Agricultural demonstrator stationed at the headquarters of your taluk will help you to raise such a nursery.

(One Madras measure of paddy is about 2½ lbs.)

Correspondence.

AGRICULTURAL PROPAGANDA—AN IDEA

To

The Editor,

Madras Agricultural Journal.

Sir,

Due to the efforts of a former Director of Agriculture we have on hand a set of very nice songs on agricultural improvements; more could probably be composed. Their practical use at present is very limited, indeed, as most of the demonstrators are not talented musicians. What I suggest is that the services of renowned musicians (e. g. Musiri Subramania Ayyar, S. D. Subbalakshmi, K. B. Sundarambal, Chembai Vaidyanadha Bagavathar, and others) may be secured to sing our songs for gramaphone recording and making use of these records in propaganda in villages. Each demonstrator could probably be equipped with a gramaphone and a set of these records to play for the amusement of the villagers when he halts amidst them in his tours. This will be a very effective method of securing a good audience in the villages and inculcate in them new ideas. The songs may also be broadcast through the radio recently introduced in Madras. Records can also be made of set speeches in the different vernaculars on various subjects by persons who have a fine recordable voice and other attributes of a good lecturer and these can be played in villages, cinema halls, radio broadcasting stations, etc. either by themselves or interposed with gramaphone music referred to in the paragraph. This method of propaganda is adopted by some of the trade concerns e. g. Horlicks, Lux Toilet Soap, etc. with conspicuous success.

A member of the M. A. S. U.

[We invite correspondence on this subject. Ed. M. A. J.]

Crop and Trade Reports.

Paddy--1938-39—Intermediate report. The main crop of paddy has been or is being harvested in parts of the Circars, the Deccan, the Central districts and Tanjore. The yield is reported to be normal in Guntur, Kurnool and Anantapur and below normal in the other districts.

The crop has been affected by drought in most of the important paddy growing areas, especially in the Carnatic and the Central districts owing to the failure of the North-east monsoon rains. The crop has also been affected by an attack of insects in parts of Coimbatore.

The wholesale price of paddy per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 9th January 1939 was Rs. 3—6—0 in Vellore, Rs. 2--14—0 in Madura, Rs. 2—13—0 in Chittoor, Rs. 2—11—0 in Virudhunagar, Rs. 2—10—0 in Trichinopoly, Rs. 2—9—0 in Tinnevelly, Rs. 2—6—0 in Vizianagaram and Cuddalore, Rs. 2—5—0 in Rajahmundry, Guntur and Kumbakonam, Rs. 2—4—0 in Ellore, Bezwada, Masulipatam and Conjeevaram, Rs. 2—3—0 in Nagapatam, Rs. 2—2—0 in Cocanada, Rs. 2—0—0 in Hindupuram, Rs. 1—15—0 in Mangalore and Rs. 1—14—0 in Anantapur. When compared with the prices published in the last report, i. e those which prevailed on 5th December 1938 these prices reveal a rise of about 59 per cent in Vellore, 19 per cent in Cuddalore, 13 per cent in Negapatam and Chittoor, 12 per cent in Kumbakonam, 9 per cent in Conjeeveram, 8 per cent in Trichinopoly, 5 per cent in Madura and 3 per cent in Tinnevelly and a fall of about 12 per cent in Guntur, 11 per cent in Hindupur, 10 per cent in Bezwada and Virudhunagar, 8 per cent in Cocanada and 5 per cent in Ellore, the prices remaining stationary in Vizianagaram, Rajahmundry and Mangalore.

Cotton—1938-39—Third forecast report. The average of the areas under cotton in the Madras Province during the five years ending 1936-37 has represented 9·6 per cent. of the total area under cotton in India.

The area under cotton up to the 25th November 1938 is estimated at 1,505,400 acres. When compared with the area of 2,118,600 acres estimated for the corresponding period of last year, it reveals a decrease of 28·9 per cent.

The decrease in area is general in all the important cotton growing districts of the Province and is attributable largely to unfavourable season conditions.

The area under irrigated cotton, mainly cambodia, is estimated at 129,400 acres as against 227,400 acres in the corresponding period of last year thereby representing a decrease of 43·1 per cent.

Pickings of the *mungari* or early sown crop in parts of the Deccan are in progress and the yield is expected to be normal. The condition of the *hingari* or late sown crop in the Deccan is also satisfactory. The growth of the crop in the Central Districts has been affected to some extent due to the withholding of the North-east monsoon rains.

Yields below normal are reported from all the districts outside East Godavari, West Godavari, Guntur, the Deccan (Cuddapah excepted), South Arcot, Chittoor, Tanjore and the West Coast. The seasonal factor for the Province as a whole works out to 97 per cent. of the average as against 93 per cent. in the previous year. On this basis, the total yield is estimated at 294,200 bales of 400 lb. lint as against 439,700 bales of last year, thereby representing a decrease of 33·1 per cent. The crop is young and it is too early to estimate the yield with any degree of accuracy.

The estimated area and yield according to varieties are given below :-

(Area in hundreds of acres, i.e., 00 being omitted ; yield in hundreds of bales of 400 lb. lint, i e., 00 being omitted.)

Variety.	Area from 1st April to 25th November.		Corresponding yield.	
	1938. Acs.	1937. Acs.	1938. Bales.	1937. Bales.
(1)	(2)	(3)	(4)	(5)
Irrigated Cambodia	127,4	217,4	73,3	135,9
Dry Cambodia	159,6	245.2	32,1	53,2
Total, Cambodia ...	287,0	462.6	105,4	189,1
Karunganni in Coimbatore ...	47,0	115,5	9,3	26,2
Uppam in the Central districts ...	17,2	27,0	2,7	4,9
Nadam and Bourbon	2,5	21,8	2	1,1
Total, Salems ...	66,7	164,3	12,2	32,2
Tinnevellies*	223,0	326,0	54,6	83,9
Northerns and Westerns ...	820,0	1,041,0	102,2	111.7
Cocanadas	103,5	117,7	19,2	21,9
Others	5,2	7,0	6	9

* Includes Uppam, Karunganni and mixed country cotton in Madura, Ramnad and Tinnevelly.

The local cotton trade is not generally active at this time of the year. The average wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 5th December 1938 was about Rs. 13-13-0 for Cocanadas, Rs. 16-7-0 for Red Northerns, Rs. 14-4-0 for White Northerns, Rs. 12-7-0 for Westerns (*mungari* crop), Rs. 13-7-0 for Westerns (*jowari* crop), Rs. 25-1-0 for Coimbatore Cambodia, Rs. 20-1-0 for Southern Cambodia, Rs. 21-4-0 for Coimbatore Karunganni, Rs. 20-8-0 for Tinnevelly Karunganni, Rs. 17-11-0 for Tinnevellies, and Rs. 17-9-0 for Nadam cotton. When compared with the prices published in the last report, i. e., those which prevailed on 7th November 1938, these prices reveal a rise of about 32 per cent. in the case of Tinnevelly Karunganni, 24 per cent. in the case of Tinnevellies, 20 per cent. in the case of Southern Cambodia, 13 per cent in the case of Coimbatore Cambodia, 11 per cent. in the case of Westerns (*mungari* crop) 7 per cent. in the case of Coimbatore Karunganni and Nadam and 3 per cent. in the case of Westerns (Jowari crop), the prices of Cocanadas and Northerns (red and white varieties) remaining stationary.

Cotton—1938-39—Intermediate forecast report. Pickings of the *mungari* or early sown crop in parts of the Deccan are in progress and the yield is expected to be normal. The *hingari* or late sown crop in Kurnool, Bellary and Cuddapah received a set back owing to the withholding of the North-east monsoon rains but the cold winds have pulled up the crop to some extent. Poor and insufficient rains during the North-east monsoon period affected the growth of the crop in the central districts. In Salem and Coimbatore the crop was also affected to some extent by the attack of insects. The condition of the crop is fairly satisfactory elsewhere in the Province.

The wholesale price of cotton lint per imperial maund of 82,2/7 lbs. as reported from important markets on 9th January 1939, was Rs. 15-4-0 for Cocanadas, Rs. 14-13-0 for red Northerns, Rs. 13-7-0 for white Northerns, Rs. 12-12-0 for Westerns (*mungari* crop) Rs. 13-12-0 for westerns (*jowari* crop), Rs. 25-1-0 for Coimbatore Cambodia, Rs. 20-6-0 for Southern Cambodia, Rs. 21-8-0 for

Coimbatore Karungari, Rs. 19-13-0 for Tinnevellies Karunganni, Rs. 18-7-0 for Tinnevellies and Rs. 17-14-0 for Nadam cotton. When compared with the prices published in the last report i. e. those which prevailed on 5th December 1938, these prices reveal a rise of about 10 per cent in the case of Cocanadas, 4 per cent in the case of Tinnevellies, 3 per cent in the case of westerns (early crop), 2 per cent in the case of Westerns (late crop), Southern Cambodia and Nadam cotton and 1 per cent in the case of Coimbatore Karunganni and a fall of about 10 per cent in the case of red Northerns, 6 per cent in the case of white Northerns and 3 per cent in the case of Tinnevelly Karunganni, the price of Coimbatore Cambodia remaining stationary.

Groundnut—1938—Fourth or final report. The average of the areas under groundnut in the Madras Province during the five years ending 1936-37 has represented 47·8 per cent of the total area under grountnut in India.

The area sown with groundnut in the Province in 1938 is estimately at 3,835,300 acres. When compared with the corresponding estimate of 4,564,800 acres for the previous year and the acutual area of 4, 657,596 acres according to season and crop report of the previous year, the present estimate reveals a decrease of 16·0 per cent and 17·7 per cent respectively. The estimated area for this year exceeds the average area of 3,075,230 acres by about 24·7 per cent.

The decrease in area is general outside Vizagapatam, East Godavari, Chingleput, Coimbatore, Trichinopoly and Malabar.

3. The harvesting of the summer and early crop of groundnut had concluded by the end of October. The harvesting of the winter or main crop is proceeding.

The crop was affected by heavy rains at the time of harvest in Kistna and by drought in most of the other districts. The crop has also been affected to some extent by an attack of insect pests in Bellary, Anantapur and Salem. In consequence, the yield is expected to be below normal outside East Godavari, Guntur, Tinnevelly and Malabar. The yield is estimated to be very low in Kistna (59 per cent), Nellore (55 per cent), South Arcot (47 per cent) and North Arcot (56 per cent). The seasonal factor for the Province as a whole works out to 76 per cent of the average as against 88 per cent in the previous year according to the season and crop report. On this basis, the yield is expected to be 1,448,500 tons of unshelled nuts as against 2,059,270 tons in the previous year, a decrease of 29·7 per cent. The yield in an average year is estimated at 1,540,280 tons.

The wholesale price of groundnut (shelled) per imperial maund of 82.2/7 lbs. (equivalent to 3,200 tolas) as reported from important markets on 9th January 1939 was Rs. 4-5-0 in Cuddalore Rs. 4-1-0 in Vizagapatam, Rs. 4-0-0 in Guntur, Rs. 3-14-0 in Vizianagaram, Rs. 3-9-0 in Coimbatore and Anantapur, Rs. 3-8-0 in Cuddapah, Vellore and Tadpatri, Rs. 3-4-0 in Nandyal, Rs. 3-3-0 in Adoni and Hindupur and Rs. 3-2-0 in Bellary. When compared with the prices published in the last report i. e. those which prevailed on 7th November 1938, these prices reveal a rise of about 19 per cent in Tadpatri, 13 per cent in Hindupur, 12 per cent in Vizagapatam, Cuddapah and Coimbatore, 11 per cent in Adoni, 10 per cent in Guntur and Nandyal, 9 per cent in Vizianagaram and Cuddalore and 6 per cent in Bellary and Vellore and a fall of about 5 per cent in Anantapur.

Castor—1938—First or Final Report. The average of the areas under castor in the Madras Province during the five years ending 1936-37 has represented 18·6 per cent. of the total area under castor in India,

The area under castor in the Madras Province up to 25th November 1938 is estimated at 256,000 acres. When compared with the area of 240,800 acres estimated during the corresponding period of last year, it reveals an increase of 6·3 per cent. The estimate for last year was below the actual area of 246,718 acres by 2·4 per cent.

An increase in area is estimated in Vizagapatam, Guntur, the Deccan, Nellore, South Arcot, Chittoor, North Arcot, Trichinopoly, Tanjore and Malabar partly counterbalanced by an estimated decrease in area in East Godavari, West Godavari, Kistna, Salem, Coimbatore, Madura and Tinnevelly.

The yield is expected to be slightly above normal in Kurnool and Bellary, below normal in North Arcot, Salem and Coimbatore and normal in the other districts. The crop has been affected by drought to some extent in parts of the districts of Chittoor, North Arcot, Salem and Coimbatore. The seasonal factor for the Province as a whole is estimated to be 100 per cent. (normal) as against 94 per cent. for the corresponding period of the previous year and 90 per cent. according to the season and Crop report of last year. On this basis, the yield is estimated at 25,700 tons as against 24,000 tons estimated for the corresponding period of last year and 22,360 tons estimated in the season and crop report of last year.

5. The wholesale price of castor seed per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 19th December 1938 was Rs. 5-4-0 in Nandyal. Rs 5-2-0 in Cuddapah, Rs. 4-12-0 in Vizagapatam, Rs. 4-10-0 in Vizianagaram, Rs. 4-8-0 in Guntur and Anantapur, Rs. 4-3-0 in Salem, Rs. 4-2-0 in Hindupur and Rs. 4-1-0 in Bellary. When compared with the prices reported in the previous year, i. e., those which prevailed on 20th December 1937, these prices reveal a rise of 17 per cent. in Cuddapah, and a fall of 14 per cent. in Salem, 13 per cent. in Vizagapatam and Vizianagram, 12 per cent. in Guntur, 11 per cent. in Hindupur and 2 per cent. in Bellary, the prices remaining stationary in Nandyal and Anantapur.

Gingelly—1938-39—Third Report. The average of the areas under gingelly in the Madras Province during the five years ending 1936-37 has represented 15·4 per cent of the total area under gingelly in India.

The area sown with gingelly up to 25th December 1938 is estimated at 575,300, acres. When compared with the area of 546,400 acres estimated for the corresponding period of last year, it reveals an increase of 5·3 per cent.

There is an increase in area in the Circars (Vizagapatam excepted), the Deccan, Nellore, South Arcot, Trichinopoly and the South partly counterbalanced by a decrease in area in the rest of the Province. The variations are marked in Vizagapatam (minus 22,000 acres), East Godavari (plus 12,000 acres), West Godavari (plus 26,000 acres), Anantapur (plus 10,000 acres) Chingleput (minus 11,700 acres), North Arcot (minus 23500 acres), Coimbatore (minus 10,000 acres) and Trichinopoly (plus 29,000 acres).

The main crop has been harvested except in the South. The crop was affected by heavy rain at the time of harvest in Kistna and by drought in most of the other districts. In consequence, the yield is reported to be below normal in all districts except West Godavari, Guntur, Kurnool, Bellary, Anantapur, Tanjore, Tinnevelly and South Kanara.

The seasonal factor for the province works out to 84 per cent of the average as against 90 per cent for the corresponding period of last year. On this basis, the yield is estimated at 65,400 tons as against 66,300 tons for the corresponding period of last year, a decrease of 1·4 per cent.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th January 1939 was Rs. 6-12-0 in Trichinopoly, Rs. 6-10-0 in Tinnevelly, Rs. 6-1-0 in Salem, Rs. 6-0-0 in Cocanada, Rs. 5-15-0 in Cuddalore, Rs. 5-11-0 in Rajahmundry, Rs. 5-9-0 in Ellore, Rs. 5-4-0 in Vizagapatam, Rs. 5-2-0 in Vizianagaram and Tuticorin. When compared with the prices published in the last report, i. e., those which prevailed on

7th November 1938, these prices reveal a rise of about 12 per cent in Cocanada, 11 per cent in Vizagapatam, 10 per cent in Ellore 8 per cent in Tinnevelly, 7 per cent in Rajahmundry and 3 per cent in Trichinopoly and a fall of about 8 per cent in Tuticorin, the prices remaining stationary in Vizianagaram, Cuddalore and Salem.

Ginger--1938—Final Report. The area under ginger in 1938 is estimated at 11,300 acres in Malabar and 500 acres in South Kanara as against the actual area of 10,994 acres in Malabar and 515 acres in South Kanara in the previous year.

The crop was affected by 'soft rot' in parts of Malabar and the seasonal factor in the District is estimated at 90 per cent. of the normal. On this basis, the yield is expected to be 3,630 tons of dry ginger as against 3,930 tons in the previous year. A normal crop is expected in South Kanara and the yield in that district is estimated at 180 tons of dry ginger.

Pepper—1938—Final report. The area under pepper in 1938 in the districts of Malabar and South Kanara is estimated at 102,800 acres (94,000 acres in Malabar and 8,800 acres in South Kanara) as against the final area of 104,081 acres (95,279 acres in Malabar and 8,802 acres in South Kanara) in the previous year.

The flowering of the crop is reported to be not very satisfactory. The seasonal factor is estimated at 80 per cent of the average in both the districts as against 90 per cent in Malabar and 95 per cent in South Kanara in the previous year. On this basis the yield is estimated at 7,900 tons (7,220 tons in Malabar and 680 tons in South Kanara) as against 9,120 tons (8,340 tons in Malabar and 780 tons in South Kanara) in the previous year.

The wholesale price of pepper per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 9th January 1939 was Rs. 11-13-0 in Calicut, Rs. 11-6-0 in Tellicherry and Rs. 12-4-0 in Mangalore. When compared with the prices published in the last report i. e. those which prevailed on 5th September 1938, these prices reveal a fall of about 6 per cent in Calicut, 3 per cent in Tellicherry and 1 per cent in Mangalore. (*Director of Industries and Commerce, Madras.*)

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1938 to 20th January 1939 amounted to 542,501 bales of 400 lb. lint as against an estimate of 505,200 bales of the total crop of 1937-38. The receipts in the corresponding period of the previous year were 514,982 bales. 463,511 bales mainly of pressed cotton were received at spinning mills and 116,674 bales were exported by sea while 84,077 bales were imported by sea mainly from Karachi and Bombay.

(*Director of Agriculture, Madras.*)

College News and Notes.

Students' Tour. The second year B. Sc. students were on tour to the Southern Districts from the 3rd January and returned to the Headquarters on the afternoon of the 19th January. They visited Tindivanam, Palur, Nellikuppam, Aduturai, Tanjore, Pattukottai, Trichinopoly, Madura, Koilpatti, Dindigul and Kodaikanal.

Students' Club. Under the auspices of the Madras Agricultural College Students' Club, Sri. N. Subramania Ayyar delivered a very interesting and instructive lecture on "Federation" on 16—1—39. Sri. M. Kanti Raj, M. A., B. Sc. (Edin) presided. Before the proceedings commenced a condolence resolution on the passing of the Hon'ble Sri. K. Raman Menon was passed.

Cricket. A full day match between an All Coimbatore XI and the Agricultural College XI was played on 14—1—39 on the college grounds. The match ended in a draw. The college entering first, scored 258. (S. V. Srinivasan 92 not out, K. K. R. Menon 59, Mukundan 25, C. N. Babu 24). The Coimbatore XI made 151 for 3 when stumps were drawn for the day (Venkatachalam 60 not out, Kunhahmed 42, Suri 23 and P. S. Srinivasan 15 not out.)

New Year Honours. We are glad to note that the Government have been pleased to confer the title of Rao Bahadur in the recent New year honours list on Sri. V. Ramanatha Ayyar, Cotton Specialsit. We congratulate him on his well-merited distinction.

Crickets Honours. We are glad that Mr. C. Ramaswami, the All-India Test cricketer, was chosen to captain the Madras team against Bengal in the semi-final of the Inter-provincial contest for the Rangi cricket trophy.

Visitors. Rev. Father Robert Miranda S. J. of the Sacred Heart College, Madura visited the College and Research Institute on 8th December 1938.

Mr. F. J. Saunders, Director of Veterinary Services, Madras, accompanied by Mr. R. W. Littlewood, the Livestock Development Officer, Hosur, inspected the cattle farm and dairy herd on the 22nd January 1939.

Mr. Ariyant Manjikul B. Ag. of the Department of Agriculture, Siam, who was on a tour of the centres of agricultual research in India, visited Coimbatore on the 21st January. After visiting the Research Institute, central farm and cotton station Mr. Manjikul left Coimbatore for Travancore.

A Successful Co-operative Milk Supply Union. We are glad to publish the following extracts from the Inspection notes by the Joint Registrar of Co-operative Societies, Madras, on the working of the Coimbatore Co-operative Milk Supply Union, Ltd.

"The Board of Directors of the Milk Supply Union, Coimbatore have to be congratulated on the splendid work turned out against tremendous odds. Their progressive policy and untiring zeal have contributed in no small measure to the successful working of the institution which has begun to work at a profit, fully hopeful of wiping off before April 1939, the loss sustained at the early stages. There is ample scope for development and I hope the citizens of Coimbatore will not fail to respond to the call of pure milk and pure butter."

The late Sri P. Gopalarathnam.

It is with deep regret that we record the sad demise of Sri P. Gopalarathnam, L. Ag., Assistant, Cotton Section, who was recently promoted as Superintendent, Tobacco Research Station, Guntur. Sri Gopalarathnam was ailing from acute intestinal obstruction and his death took place on the 3rd January at the Government Headquarters Hospital, Guntur.

Sri Gopalarathnam was a loyal member of the Madras Agricultural Students' Union and has made several contributions to the pages of this Journal.

We offer our sincere condolences to the members of the bereaved family.

Weather Review—DECEMBER 1938.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	-0·7	42·2
	Calingapatam	0·0	-1·31	40·10
	Vizagapatam	0·0	-0·70	50·90
	Anakapalli*	0·0	-0·16	50·80
	Samalkota*			
	Maruteru*	0·0	-0·82	47·23
	Cocanada	0·0	-0·86	55·40
	Masulipatam	0·0	-0·72	32·10
	Guntur*	0·0	-0·10	34·50
Ceded Dists.	Kurnool	0·0	-0·25	23·50
	Nandyal*	0·0	-0·11	34·33
	Hagari*	0·0	-0·14	22·87
	Siruguppa*	0·0	-0·38	28·64
	Bellary	0·0	-0·08	23·40
	Anantapur	0·0	-0·17	29·40
	Rentachintala	0·0	...	28·70
	Cuddapah	0·0	-0·79	33·40
	Anantharajupet*	0·31	-2·51	23·81
Carnatic	Nellore	0·70	-2·58	30·40
	Madras	2·40	-2·95	26·50
	Palur*	1·82	-5·64	41·50
	Tindivanam*	0·99	-3·79	28·92
	Cuddalore	3·70	-3·94	33·90
Central	Vellore	1·30	-1·57	32·90
	Salem	1·00	+0·05	29·90
	Coimbatore	1·20	+0·12	12·70
	Coimbatore A. C. & R. I.*	0·74	-1·60	13·20
	Trichinopoly	1·90	-0·69	22·90

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·40	-10·50	48·10
	Aduthurai*	9·08	+0·55	35·57
	Madura	1·80	-0·18	28·30
	Pamban	5·50	-2·05	26·50
	Koilpatti*	4·17	+1·54	32·35
	Palamkottah	3·30	-0·67	30·60
West Coast	Trivandrum	1·60	-0·83	56·00
	Cochin	0·80	-0·90	87·60
	Calicut	0·10	-0·96	132·90
	Pattambi*	0·10	-0·81	87·93
	Taliparamba*			
	Kasargode*	0·0	-0·95	140·40
	Nileshwar*	0·0	-0·75	149·82
	Mangalore	0·0	-0·46	143·80
Mysore and Coorg	Chitaldrug	0·0	-0·30	21·20
	Bangalore	0·0	-0·50	31·50
	Mysore	0·40	0·0	19·40
	Mercara	0·90	-0·20	135·30
Hills	Kodaikanal	7·80	+3·40	54·10
	Coonoor			
	Ootacamund*	2·41	-0·93	40·12
	Nanjanad*	2·24	+0·37	35·90

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Except for a few light showers in southeast Madras, rainfall was in defect in the Presidency, and cool dry weather prevailed in the Peninsula. On the 6th a trough of low pressure appeared to the south-east of Ceylon causing rains in south-east Madras and as it persisted on 7th and 8th, it caused local rains in the south of the Peninsula. The North East Monsoon strengthened in Ceylon on the 24th and with it appeared unsettled conditions in the south-east of Arabian sea. On the 27th the North East Monsoon was active causing widespread rain in the south of Peninsula.

Skies were generally lightly to moderately clouded in the Madras Presidency and clear or lightly clouded in other parts of the Peninsula. Rainfall was in defect throughout, markedly so on the Coromandel coast.

Humidity except for a few days in the North Madras Coast was always in defect in the Konkan, Malabar and Southeast Madras.

The maximum temperature was generally below normal in the Madras Presidency and the minimum temperature was above normal.

Weather Report for Research Institute Observatory:

Report No. 12/38.

Absolute maximum in shade	...	88°F.
Absolute minimum in shade	...	58·7°F.
Mean maximum in shade ...	...	84·8°F.
Departure from normal ...	...	-0·1°F.
Mean minimum in shade ...	...	65·7°F.
Departure from normal ...	...	-1·1°F.
Total rainfall ...	...	0·74"
Departure from normal ...	...	-1·60"
Heaviest fall in 24 hours ...	...	0·50" on 27th.
Total number of rainy days	...	2
Mean daily wind velocity ...	...	2·3 M. P. H.
Mean humidity at 8 hours ...	...	78·9%
Departure from normal ...	...	-0·8%

The weather was fine and moderately to heavily clouded throughout the month except during the last three days. Rainfall was in defect by 1·6". The day and night temperatures and humidity were also below normal.

P. V. R. & J. C.

Departmental Notifications.

Promotions.

Substantive Promotions.

Sri. G. Ganapathy Ayyar, Permanent Assistant in Chemistry section from II Grade to I Grade. Rs. 225 to 250 with effect from 14-1-38.

Sri. S. Dharmalinga Mudaliyar, Permanent Assistant in Paddy section from III Grade to II Grade. Rs. 200 to 225 with effect from 14-1-38.

Sri. B. S. Narasimha Ayyar, Permanent Assistant in Chemistry section from IV Grade to III Grade. Rs. 120-10-170 to 200 with effect from 14-1-38.

Sri. C. Rajasekhara Mudaliar. Permanent Assistant in Paddy section from V Grade to IV Grade. Rs. 85-5-120 to Rs. 120-10-170 with effect from 14-1-38.

Provisionally Substantive Promotions.

Mr. Samuel Jobitha Raj. Permanent Assistant in Paddy section from II Grade to I Grade. Rs. 225 to Rs. 250 with effect from 14-1-38.

Sri. K. Govindan Nayar, Permanent Assistant in Chemistry section from III Grade to II Grade. Rs. 200 to Rs. 225 with effect from 14-1-38.

Mr. C. M. John, Permanent Assistant, Oil seeds section from IV Grade to III Grade Rs. 120-10-170 to Rs. 200 with effect from 14-1-38.

Sri. T. Varahalu, Permanent Assistant in Chemistry section from V Grade to IV Grade. Rs. 85-5-120 to Rs. 120-10-170 with effect from 1st April 1938.

Transfers.

Name of officers.	From	To
Sri. K. M. Venkatachalam Pillai.	A. D., Kallakurichi.	Ground-nut Ware-house, Cuddalore.
„ Kuppumuthu.	Ground-nut Ware-house, Cuddalore.	A. D., Cuddalore.
„ E. Achyuthan Nayar.	A. D., Kallakurichi.	A. D., Gingee.
„ T. K. Mukundan.	A. D., Podanur Factory Area.	A. D., Cannanore.
„ T. Gopolan Nayar.	A. D., Cannanore.	F. R. S., Koduru.
Janab S. Varisai Muhammad Sahib.	Offg. Ass. Paddy Section.	Offg. Asst. in Mycology, Coimbatore.

Leave.

Name of officers.	Period of leave.
Sri. N. Raghava Rao, A. D., Narasannapet.	L. a. p. for 21 days from 23-1-39.
" P. V. Hariharan, Asst. in Millets, A. R. S., Palur.	Extension of l. a. p. on m. c. for 1 month from 11-12-38.
" K. E. Viswam, A. A. D., Tiruvannamalai.	L. a. p. for 10 days from 3-1-39.
" R. Anandapadmanabha Pillai, A. D., Nandyal.	L. a. p. for 55 days from 19-12-38.
" S. Kuppuswami Ayyangar, A. D., Sriperumbudur.	L. a. p, for 4 months from 22-1-39.
" K. V. Reddy Naidu, A. D., (on leave).	Leave on loss of pay on m. c. for 1 month and 23 days from 31-10-38.
" T. G. Muthuswami Ayyar, F. M., A. R. S., Pattukottai.	L a. p. for 5 days from 3-1-39.
" P. S. Narayana Ayyar.	Extension of l. a. p. for 1 month and 8 days from 24-12-38.
" P. V. Subba Rao, Asst. A. D. (on leave).	Extension of l. a. p. on m. c. for 2 months from 15-11-38.
" F. L. Daniel, Offg. Asst in Chemistry, Coimbatore.	L. a. p. for 31 days from 6-1-39.
" C. S. Balasubramanian, Asst. in Entomology, Cuddapah.	L. a. p. for 3 days from 3-1-39.
" T. Nataraj, Teaching Assistant.	L. a. p. for 1 month from 10-1-39.
" K. Varadachari, A. D., Chingleput.	L. a. p. for 16 days from 10-1-39.
" S. Ramachandra Rao, Asst. in Paddy, Buchireddipalem.	L. a. p. for 15 days from 6-1-39.
" K. E. Viswam, Asst. A. D., Tiruvannamalai.	L. a. p. for 10 days and extension of l. a. p. for 15 days from 3-1-39.
" S. Sangameswara Sarma, Offg. F. M., A. R. S., Anakapalle.	Earned leave for 14 days and extension of leave (without leave salary) for 30 days from 3-1-39.

Gazette Notifications.

Name of officers.	Period of leave.
Sri. Rao Sahib G. Jogi Raju, Asst. Director of Agriculture, Vizagapatam.	L. a. p. for 4 months and half average pay for 4 months and 26 days preparatory to retirement from 3—1—39.
Mr. A. C. Edmonds, Dy. Director, III Circle (old) Bellary.	Extension of leave on half average pay out of India for 8 days from 30-3-39.

Agricultural College & Research Institute, Coimbatore.

Additions to the Library during December 1938.

A. Books.

1. *Biodynamic Farming and Gardening.* Pfeiffer, E. (1938). 2. *The Soil and Social Reclamation.* Watson, G. C. (1938). 3. *Native Woody Plants of the United States: Their Erosion Control and Wildlife values.* Van Dersal, W. R. (1938). 4. *Bibliography on Soil Erosion and Soil and water conservation.* Gaines, S. H. (1938). 5. *The Land System in South India between 800 A. D. and 1,200 A. D.* Gupta, K. M. (1933). 6. *Third Conference on Cotton Growing Problems.* Emp. Cotton Grow. Crop. Pub. (1938). 7. *Poisonous Plants on the Farm.* Long. H. C. (1938). 8. *Simplified Market Research.* Coutant, F. R. & Doubman, J. R. (1938). 9. *The Theory and Measurement of Demand.* Schultz, H. (1938). 10. *The Study of Heredity.* Ford, E. B. (1938). 11. *Genetics.* Walter, H. E. (1938). 12. *More difficulties of the Evolution Theory.* Dewar, D. (1938). 13. *The Growth of Plants in relation to Cultivation (Cantor Lectures).* Tincker, M. A. H. (1938). 14. *Report on the Marketing of Eggs in India and Burma.* India Marketing Series No. 9. (1938). 15. *British Breeds of Livestock.* Eng. Min. of Agri. Pub. (1938). 16. *The Cattle Wealth of India.* Maniam, C. V. S. (1938). 17. *First Imperial Conference on Agricultural Co-operation.* (1938). 18. *Lectures and Conferences on Mathematical Statistics.* Neymen, J. (1938).

B. Reports Etc.

1. Administration Reports of the Madras Agricultural Chemist, Entomologist and Mycologist for 1937–38. 2. Report of the Agri-Horticultural Society of Madras for 1937–38. 3. Administration Report of the Electricity Department for 1937–38. 4. Annual Administration Report of the Madras Civil Veterinary Department for 1937–38. 5. Report on the Administration of the Department of Agriculture for the year ending 30th June 1937. 6. Progress Report of the Institute of Plant Industry, Indore, Central India for the year ending 31st May 1938. 7. Report on the operations of the Department of Agriculture, Burma for the year ended the 31st March 1938. 8. Annual Report of the Department of Agriculture, Mysore for the year 1936–37. 9. Report on the Administration of the Meteorological Department of the Government of India in 1937–38. 10. Plantation Crops: A summary of figures of Production and Trade relating to Sugar, Tea, Coffee, Cocoa, Spices, Tobacco and Rubber, 1938. 11. Twentieth Annual Report of the National Research Council, Ottawa for 1936–37. 12. Annual Report of the Department of Agriculture and Fisheries, Palestine for the year ending 31st March 1938. 13. The Report of the Department of Agriculture, Gambia for the period ending 31st May 1938. 14. Administration Report of the Director of Agriculture, British Guiana for the year 1937. 15. Annual Report of the Agricultural Experiment Station, Gainesville, Florida for the fiscal year ending June 30, 1937. 16. Annual Report of the Maine State Pomological Society for 1936—1938. 17. Fiftieth Annual Report of the Agricultural Experiment Station of Nebraska, 1937.